

Recent Research Trends in Medical and Health Sciences



Editors

**Dr. C. Balalakshmi and
Dr. Parvathy Unnikrishnan**



**MKSES PUBLICATIONS
LUCKNOW, INDIA**

Recent Research Trends in Medical and Health Sciences

Editors

Dr. C. Balalakshmi

Assistant Professor

**Department of Nanoscience and Technology,
Alagappa University, Tamilnadu (India)**

Dr. Parvathy Unnikrishnan

Assistant Professor

**Department of Striroga and Prasutitantra (Gynaecology & Obstetrics),
Amrita School of Ayurveda, Kollam, Kerala**



MKSES Publisher (India)

MKSES Publisher (India)

Publisher Address: Head Office: 1st Floor, Building No-85A, (Nanak Arcade near Sani Mandir, Parag road, LDA colony, Kanpur Road, Lucknow-226012

Mobile No: +91 9838298016, +91 8299547952 Office Land line No: +91 5223587193

E-mail: mkpublication@gmail.com

Website: www.mksepublications.com

Copyright© MKSES Publisher Lucknow India

First Published: **Sept, 2023**

ISBN: 978-93-91248-91-8

Page No. 1-75

Disclaimer: The views expressed by the authors are their own. The editors and publishers do not own any legal responsibility or liability for the views of the authors, any omission or inadvertent errors.

© All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without the prior written permission of the publishers.

Preface

The present volume is based on the contributions made by various authors on different important topic of “**Recent Research Trends in Medical and Health Sciences**” and introduces the subject along the following topics: Methods in Improving Short Term Memory: A Brief Review; Are Children Falling into the Trench of Fast Food?; Biomedical Research Ethics: Past, Present and Future; Early (Short-Term) Side-Effects of Chemotherapy in Pediatric Solid Tumors; Health and Pollution in Banbishnupur village, Haldia, West Bengal; A Study to Evaluate the Morphometric measures of Gonial angle and Bi-gonial width for Healthy Individuals in Garden City university dental camp; Prevalence of Overweight and Obesity (overnutrition) among the Bengali Adolescent Girls: A Cross-Sectional Study from Darjeeling District, West Bengal (India). We must place on record our sincere gratitude to the authors not only for their effort in preparing the papers for the present volume, but also their patience in waiting to see their work in print. Finally, we are also thankful to our publishers **Mrs. Shweta Singh** M/S MKSES Publishers, Lucknow for taking all the efforts in bringing out this volume in short span time.

Editors

Contents

Chapter No.	Chapter Name	Page No.
1.	Methods in Improving Short Term Memory: A Brief Review <i>Amera Anjum Saifee, Varsha Akhade, Sreelekshmi P. and Saanshita Devi</i>	1-6
2.	Are Children Falling into the Trench of Fast Food? <i>Prathibha G, Anjaly Muraleedharan, Hemavathi Shivapura Krishnarajabhatt, and Parvathy Unnikrishnan</i>	7-14
3.	Biomedical Research Ethics: Past, Present and Future <i>Dr. Tejas A. Acharya</i>	15-22
4.	Artificial Intelligence (AI) in Anatomy Education: Opportunities, Challenges, and Ethical Considerations <i>Md. Jawed Akhtar, Sufia Parveen and Md. Kashif Akhtar</i>	23-31
5.	Early (Short-Term) Side-Effects of Chemotherapy in Pediatric Solid Tumors <i>Dr. Geetika Mathur</i>	32-39
6.	Health and Pollution in Banbishnupur village, Haldia, West Bengal <i>Soma Rani Karan</i>	40-46
7.	A Study to Evaluate the Morphometric measures of Gonial angle and Bi-gonial width for Healthy Individuals in Garden City university dental camp <i>Sandhya Nagolu, Dr S Jeyakumar, Anugula Divya Sai and Vrinda TA</i>	47-56
8.	Prevalence of Overweight and Obesity (overnutrition) among the Bengali Adolescent Girls: A Cross-Sectional Study from Darjeeling District, West Bengal (India) <i>Mampi Debnath</i>	57-66
9.	Significance of Artificial Intelligence in Oral and Maxillofacial Surgery <i>Maryam Akhtar and Eram Anwar</i>	67-75

Chapter: 1**Methods in Improving Short Term Memory: A Brief Review****Amera Anjum Saif¹, Varsha Akhade², Sreelekshmi P.³ and Saanshita Devi⁴**^{1,3,4}**PG Scholar, Department of Physiology**²**Assistant Professor, Department of Physiology****Bidar Institute of Medical Sciences Bidar, Karnataka, India****E-mail: 786012pasha@gmail.com****Introduction**

Working memory is a multicomponent system, bringing together short term memory and attention (Cowan, 2016). Having a particularly low or high capacity can affect people in many different ways, impacting daily life (Richmond *et al.*, 2015). Memory is the ability to recall past events at a conscious or unconscious level. It is a relatively permanent retention and storage of learned information. Memory function is generally divided into three categories: immediate, recent, and remote. Much can be learned about memory as the patient tells his or her story during the interview.

Low working memory capacity has been linked to inattentive behaviour, which can increase the difficulty of everyday tasks and activities requiring sustained attention (Kofler *et al.*, 2017), while STM capacity may, for example, explain individual differences in learning and reading comprehension (Haarmann *et al.*, 2003). Specific courses designed to improve WM have been implemented using different techniques and with varying levels of success (Klingberg *et al.*, 2002). Methods targeting the improvement of short term memory specifically have included rehearsal (Broadley *et al.*, 1994), visual imagery (de la Iglesia *et al.*, 2005), creating stories from the information to be remembered (McNamara & Scott, 2001), and grouping of the items into conceptual categories.

Mindfulness-based interventions have become common, owing to their affordability, ease of learning, and growing evidential support for benefits in mental health and cognitive function. Human memory behaves as if organized in 3 kinds of stores, sensory stores, short term memory and long term memory. There are four stages or phases involved in memory: impression, retention, recall (or reproduction), and recognition. The first three stages correspond roughly to making a recording on a tape recorder, storing it in your file, and then playing it back at a later date (Robert *et al.*, 1971)

The multi-store model of memory: sensory register, short term memory and long-term memory. Features of each store: coding, capacity and duration. The Multi-Store Model. The multistore model of memory was proposed by Atkinson and Shiffrin and is a structural model.

They proposed that memory consisted of three stores: sensory register, short-term memory (STM) and long-term memory (LTM). Information passes from store to store in a linear way. Both STM and LTM are unitary stores. Sensory memory is the information you get from your sense, your eyes and ears. When attention is paid to something in the environment it is then converted to short-term memory. If maintenance rehearsal (repetition) does not occur, then information is forgotten, and lost from short term memory through the processes of displacement or decay. Each store has its own characteristics: • Encoding is the way information is changed so that it can be stored in the memory.

Stages of Memory

1. ENCODING: Put into memory.

2. STORAGE: Maintain into memory.

3. RETRIEVAL: Recover from memory.

Memory Encoding: It is the initial learning of information. It is how the information coming from sensory inputs is changed into a form so it can be stored in the brain. Encoding is transforming internal thoughts and external events into short term and long term memory.

Younger adults encode memories with relative ease. The processing speed, working memory, and the ability to perceive things correctly is better in younger people. Brain activity has been seen at its peak in early life years and it declines in the later stages of life. That is why younger adults can learn and encode new information, a process that is affected in older people.

Older adults experience significant disturbances in encoding processes due to deficiencies in brain activities as compared to younger people. Older people may face difficulty with perceptual encoding and the elaborative process of encoding. Older adults cannot encode information with elaboration. It is more challenging for older people to maintain information due to changes in the function of the frontal lobe. Perception and processing speed also decline with age.

The memory encoding process may be affected by several reasons such as less sleep, anxiety, vitamin deficiency, drug abuse, etc

Visual Encoding: It is the process of converting a visual image to understand it as an object. This visual information is stored in the form of working memory.

Acoustic Encoding: The encoding of auditory information is known as acoustic encoding. It is the process of understanding the auditory aspect of an experience. It includes processing of sound, words and other auditory input for storage and later retrieval. Phonological loop which is a component of acoustic encoding involves two different processes. First, Acoustic information comes into the brain for one to two seconds. Second, rehearsal is required to convert into long term memory.

For learning to read successfully one must have good audio-visual memory. It has role in development of language and cognition. Impairment of auditory and visual short term memory leads to problems like difficulty in learning, understanding the language and performing activities respectively.

Various studies have been done previously on short term memory they have shown the differences in visual and auditory memory but the importance of encoding in auditory, and visual memory has not yet been emphasized.

Visual Short term Memory Assessment:

Cognifits complete neuropsychological assessment makes it possible to assess and evaluate visual short term memory using the following tests.

Alphabetical Test: In this test sets of alphabets like (A, E, I), (B,D,K) and (M,P,Z,X) etc can be used alphabets were shown to the subjects for few seconds and asked them to recall and note it down on the paper.

Numerical Test: In this test like alphabet test, trials can give with single digit numbers and the subjects were asked to write the numbers whatever they remembered in each trial immediately on the paper provided to them

Word Test: Students will be given a list of 15 words which are familiar to the students like **table, chair, fan, book and pen etc** and 30 seconds given to look list of words. Then the subjects will be asked to recall all the words or whatever they remember and ask them to write on a paper immediately.

Object Test: A tray containing 15 vegetables like **tomato, potato, brinjal, onion, etc.** will be shown to subjects for 30 seconds. The tray will be covered with a cloth and the subjects will be asked to write the names of objects on a paper.

Picture Test: A tray containing photographs of fruits like **apple, banana, grapes, orange etc** will be shown to subjects for **30** seconds. After withdrawal of tray, subjects will be asked to write them on a paper.

The subjects will be given a rest of 15 minutes and then the same short term memory tests will be repeated with different set of similar words, objects and photographs after asking them to apply same standard methods for improvement of short term memory.

Pattern Span Tests

In the pattern span test, a matrix pattern is shown to the subject where few cells are filled, and then a second matrix is presented to reproduce the pattern after a delay period of varying length. The test may begin with a simple matrix pattern with half of the cells filled, and then it will increase in complexity until the subject can't accurately reproduce the pattern. For a normal adult, this is around 16 cells.

Corsi Block Tapping (Test for visual and spatial short term memory assessment)

In this test subjects are shown different patterns of blocks and then asked them to replicate. After successful trials, the blocks pattern gets longer and complex as the number of blocks gets increased

Auditory short term memory Assessment:-

Word Test: Students will be given a list of 15 words which are familiar to the students like **table, chair, fan, book, pen etc.** After the experimenter read each of the auditory lists the subjects were asked to recall what they remembered and ask them to write on a paper immediately. The subjects had 30 seconds to process each word.

Digit span test: In this test examiner say a string of numbers from 2 digits to 9 digits. There are 8 items with each item consist of two trials. The examiner needs to administer both the trials even if the listener passes trial one. The digit strings will increase in length with each trial. The participants will hear a sequence of digits and then immediately prompted to verbally repeat the sequence which was heard. If participants give correct response it is scored as 1 point. Incorrect or no response is scored as 0 point. Item score is sum of scores on the two trials for that item.

DSF total raw score is obtained by summing the item scores on DSF. Maximum DSF total raw score will be 16 points. The longest digit span forward (LDSPF) is the number record on last DSF trial scored 1 point. The maximum LDSF score will be 9 points.

ENCODING METHODS

Chunking information into small groups makes it easier to remember more items for a short period. Grouping of each piece into large group can improve memory for longer. For example, a phone number sequence of 4-7 -1-3-2-4 would be chunked Into 471-1324 chunking allows people to take small bits of information and combine them into more meaningful, and therefore more memorable.

Creating Mental Associations:

Relate units to each other in meaningful ways, grouping because there are four letter words OR because they start with the same letter OR because they share a similar purpose.

Associate-linking groups of items from memory to help make things more memorable. Example. Things like **tomatoe, potato, brinjal, onion, etc.** are associated with vegetables. **apple, banana, grapes, orange etc.** are associated with fruits.

From meditation

Research into the effects of mindfulness meditation on behavioural outcomes has received much interest in recent years, with benefits for both short-term memory and working memory identified. However, little research has considered the potential effects of brief mindfulness meditation interventions or the nature of any benefits for visual short-term memory.

Some other encoding methods are also known to improve short term memory

1. Retrieval of information by creating and taking tests.
2. Spaced learning is studying something in five sessions of 10 minutes instead of studying it for continuous 50 minutes.
3. Imagination.
4. Mnemonic tools.

Conclusion: This chapter will help the researchers to know the various methods in improving short term memory status. It also helps to assess the functioning of working memory in healthy individuals and to differentiate it from various psychological and neurodegenerative disorders like Alzheimer, Parkinsons' and senile dementia. This chapter will also help to compare visual from auditory memory and helps in improving the short term memory status by applying encoding methods and practicing them for considerable period of time.

References

- Cowan, N. (2016). The many faces of working memory and short-term storage. *Psychonomic Bulletin & Review*, 24(4), 1158–1170.
- Richmond, L. L., Redick, T. S., & Braver, T. S. (2015). Remembering to prepare: The benefits (and costs) of high working memory capacity. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 41(6), 1764–1777.
- Kofler, M. J., Sarver, D. E., Harmon, S. L., Moltisanti, A., Aduen, P. A., Soto, E. F., & Ferretti, N. (2017). Working memory and organizational skills problems in ADHD. *Journal of Child Psychology and Psychiatry*, 59(1), 57–67.
- Haarmann, H. J., Davelaar, E. J., & Usher, M. (2003). Individual differences in semantic short-term memory capacity and reading comprehension. *Journal of Memory and Language*, 48(2), 320–345.
- Klingberg, T., Forssberg, H., & Westerberg, H. (2002). Training of working memory in children with ADHD. *Journal of Clinical and Experimental Neuropsychology*, 24(6), 781–791.
- de la Iglesia, C. J. F., Buceta, J. M., & Campos, A. (2005). Prose learning in children and adults with Down syndrome: The use of visual and mental image strategies to improve recall. *Journal of Intellectual and Developmental Disability*, 30(4), 199–206.
- McNamara, D. S., & Scott, J. L. (2001). Working memory capacity and strategy use. *Memory & Cognition*, 29(1), 10–17.
- Robert S.Woodworth, Harold Schoolberg. *Experimental psychology*. 1st Indian ed. New Delhi: Oxford & IBH publishing co.pvt.Ltd; 1971.
- Atkinson, R. C. and Shiffrin, R. M. *The control processes of short term memory-* Institute for mathematical studies in the social sciences, Stanford University. 1971.
- Miller, G. The magical number seven plus or minus two. Some limits on our capacity for processing information. *The Psychological Review*, 1956; 63(1):81-97.
- Errands, R. J. W. *psychiatry for medical students*. 3rd ed. Washington: American Psychiatric press; 1997.
- Saher, A. Tabassum. K, Dutta. M, Kalpana and Jaleel K. A. Short term memory status by visual tasking alphabetical tests. *Journal of pure and applied physics*. 2009;4(1): 21-29
- The magical number seven plus or minus two. 1956 Psychology paper by George Miller on working memory capacity.
- Coon, D and Miller, J. *Introduction to Psychology; Gateway to the mind and behavior*. Wadworth cengage learning; 2010.

Chapter: 2

Are Children Falling into the Trench of Fast Food?

Prathibha G¹, Anjaly Muraleedharan², Hemavathi Shivapura Krishnarajabhath³, and Parvathy Unnikrishnan^{4*}

¹PG Scholar, Department of Striroga and Prasuti Tantra, Amrita School Of Ayurveda, Amrita Vishwa Vidyapeetham, Amritapuri-690525,

²Associate Professor, Department of Striroga and Prasuti Tantra, Amrita School of Ayurveda, Amrita Vishwa Vidyapeetham, Amritapuri-690525,

³Professor and HOD, Department of Striroga and Prasuti Tantra, Amrita School Of Ayurveda, Amrita Vishwa Vidyapeetham, Amritapuri-690525,

⁴Assistant Professor, Department of Striroga and Prasuti Tantra, Amrita School Of Ayurveda, Amrita Vishwa Vidyapeetham, Amritapuri-690525,

*E-mail: parvathyunnikrishnannair@gmail.com

Abstract: A six-year-old child with a body weight of 20 kg has a daily energy requirement of 1500 kg. It is 1700 kilocalories for a 10-year-old child weighing 30 kg, 2400 kilocalories for adolescent boys, and 2200 kilocalories for teenage girls. Eating a burger, meat roll or two pieces of fried chicken provides 1200-1500 calories. This means that a six-year-old can get enough energy for a day from this alone. All the calories in the food we eat are excess energy. When it reaches the body and comes without significant physical activity, it is stored as fat in the body and increases bad cholesterol. There will be obesity and precocious puberty leading to further future risks including cancer. This is also the pathway to heart disease and other lifestyle diseases. Rather than focusing on eliminating fast food, Ayurveda can pave a new pathway to tackle them through different modalities of diet modifications and seasonal regimens.

Keywords: Fast food, Ayurveda, Lifestyle disease, Obesity, Precocious puberty

Introduction

In this fast-paced era, where each second counts, fast food has been a trendsetter. Fast food is defined as convenience food purchased in self-service or carry-out eating venues without wait service. [1] With the introduction of Swiggy and Zomato, we can get delicious food with just one swipe on our touch screen, according to our convenience. But wait, do you know the term 'Fast-food' synonym? Without much thinking, we can jump on to the word 'Junk-foods'. [2] They are foods that have imbalanced nutritional content that contains high calories, high fat, low fiber, and high sugar. [3] They come in eye-catching colors and heady smell that tempts your brain within seconds to buy them. If you have tasted it at least once in your lifetime, this time span reduces to the flick of a second. Some common fast foods in India are Fresh fries,

Hamburgers, Pizza, Donuts, Shawarma, Soft drinks, and the endless list. [4] The funny thing about them is, even after knowing that they are harmful to our lives, we ourselves clearly fall into their trap. The hidden factor or the real culprit is your own Brain. 90% of the information transmitted to the brain is visual. [5] The food industry spends more than \$1.6 billion per year in marketing their products among which advertisements are the main key to the brain of the common population. [6] They are so impressive that it creates an impact on your mind; you are tempted to buy them without anyone compelling you.

Materials and Methods

Let us give a glance at the fetus in intrauterine life. Even before birth, they are exposed to junk foods through their mother. [7] In Ayurveda, various eminent Scholars have mentioned that the mother's food can adversely affect the baby in many ways. Junk foods are known for their high salt, sugar, sour and spicy ingredients. Doughnuts and pastries are known for their intoxicating sweetness. In Ayurvedic classics, while explaining the substances that can cause harm to the fetus in the womb it is explained that if the mother has a habit of consuming excessive sweet food items, it can cause Diabetes mellitus in the offspring. If she takes, more sour food items, it can cause diseases that are related to the blood, skin, and eyes of the fetus in the future which should be remembered while taking mojitos. Packeted chips and French fries are too oily and salty while pizza and schezwan dishes are hot and spicy. When eating salty foods causes hair fall and alopecia, taking too many spicy foods will result in general weakness and even disorders at the level of sperm in the baby. Pork in excess, if taken, can cause reddish eyes and more body hairs in children. [8] Considering the increasing trend of pork-derived products like Sodium inosinate in Junk foods, this may also in future be proven in research. [9] Various studies have already shown that maternal junk food consumption during pregnancy and lactation promotes Non-Alcoholic Fatty Liver Diseases, decreases muscle force, exacerbates adiposity, and brings about Obesity in offspring. [10]

Looking into the phase of adolescence, Junk foods have proven to be one of the causes of precocious puberty in both sexes, including girls having early Menarche. [11] In Kasyapa Samhita, a book written in the Sanskrit language it is said that both sperm and ovum present in men and women respectively, come to an active state based on time and deeds. The interesting fact is the exclusive note given here that, due to dietary regimens and health, these can come to an active stage even before the normal age, which the author considered as 16 years. [12] Nowadays, a baby from a few weeks after birth is exposed to Soy milk and Formula milk, as a substitute for breast milk. The Isoflavonoids which act as Oestrogen mimics have a significant

affinity to estrogen receptors ER Alpha and ER Beta. ER Alpha is abundant in the uterus. Smaller quantities are also present in ovaries, female mammary glands, bones, hypothalamus, and pituitary glands. [13] From a study conducted on this topic, in Jordan, a lady who is being exposed to these kinds of milk in the early stages of life has increased secretion of Gonadotrophin and increased response to Leutinizing hormone (LH). This causes the secondary sexual characters to emerge quickly compared to others who is having a normal balanced diet. Since these kids have a longer accumulation period of estrogen and progesterone exposure levels, lengthening of breast mitotic activity occurs, often increasing the likelihood of tumor occurrence. [14]

During their teenage, children start getting beauty conscious and depend upon Proteinated drinks to get their dream body. Neglecting other components of food and focusing more on high dietary protein intake can cause intraglomerular hypertension, which may result in kidney hyperfiltration, glomerular injury, and proteinuria. Potential mediators of kidney damage from animal protein include dietary acid load, phosphate content, gut microbiome dysbiosis, and resultant inflammation. [15]

The next among Junk food is Caffeinated and artificially softened drinks. When their colors truly make us fall for them, they are actually altering the glucocorticoid secretion via the Hypothalamo-Pituitary-Adrenocortico axis (HPA Axis). They also cause Insulin resistance through Insulin mediated pathway. When taken in high quantities, they have the capacity to alter the Gut microbes, impact glucose regulation and also increase body weight. [16]

Various other diseases and lifestyle disorders including Obesity, Polycystic Ovarian Syndrome (PCOS), and cardiovascular disease are the gifts that you avail when you fall in love with Fast foods and get addicted to them. [17]

Fast food contains Leptin, which has multiple actions on Hypothalamus, Adrenal gland, and Epiphyseal growth plate. Studies have shown that Leptin levels are positively correlated with Obesity, which may be associated with Leptin resistance. It also stimulates Central Pulsatile Gonadotrophin secretion and triggers the timing of Puberty by binding to Gonadotrophin binding neurons. Most fast foods have an extremely high energy density, approximately, 236 kCal/100 g of food, i.e. twice that of a recommended healthy diet. Researchers have found that regular consumers of fast food had odds of being obese, that were 60%-80% higher compared with those for people who ate fast food for less than one time per week. It also contains trans-fats up to 24g/serving, which another component is leading to weight gain, abdominal fat

accumulation develop insulin resistance, and cardiovascular events. Since it contains Sodium higher than the recommended amount, it can also result in Hypertension. [18]

Considering the quantity of Ajinomoto added to these fast foods to excite your taste buds, the food colors added for attraction, and the repeated heating of the same oil, especially broasted chicken, the fact that it can lead to various cancers cannot be left unseen. When you look into the method of preparation, often they fall under the category of incompatible food items explained by the great sage Acharya Charaka, with honey garlic chicken and milkshakes being the common examples. [19]

Discussion

In a survey study conducted, it was discovered that the calorie share of whole grains is significantly higher for households in India than the EAT-Lancet recommendations while those of fruits, vegetables, legumes, meat, fish, and eggs are significantly lower. The share of calories from protein sources is only 6–8% in India compared to 29% in the reference diet. Even the richest households in India do not consume adequate amounts of fruits, vegetables, and non-cereal proteins in their diets. An average Indian household consumes more calories from processed foods than fruits. There can be innumerable reasons for this upward trend in fast food. As Indians started to adopt the lifestyle of the Westerns, gradually the idea of being reformed might have struck their minds and would have brought modern styles to their food also. As the expenditure started to sky high, every millisecond became precious in job and we have no time to spend cooking a meal. Since Junk-foods have only long-term effects, people started to take them more, assuming that they are just fine even after consuming them for days. The data that the money spent on healthcare rose from 4.7 percent to 5.7 percent indicates that while running to build up a future, we are actually destroying it. [20]

In this era, it's difficult to avoid fast food, considering its dominance in our lives. But we can gradually decrease the use of them. As per Ayurveda, unhealthy things– foods, drinks, and activities that have become accustomed to long use should be discontinued by quarter and quarter gradually. Sudden discontinuance of unhealthy regimens and foods can lead to more diseases. Similarly, healthy things should be gradually made use with intervals of 1, 2, and 3 days. The adverse effects caused due to incompatible foods, if eliminated gradually, especially according to the seasonal regimens and good habits developed gradually, lead to a healthy body and mind. Cleansing procedures of Ayurveda like emetic therapy and purgation therapy can be practiced every year under the supervision of an Ayurveda doctor to achieve this goal. [21]

It is time to concentrate more on dietary modifications rather than trying to eliminate junk foods from our life. If you find you are more attracted to 'momos', there is nothing wrong in experimenting with it and changing it to a healthy steam-made 'green gram momos'. If your children are addicted to sweet sugary snacks, for their sake, let us replace it with 'honey-soaked gooseberry'. The love for red meat can be brought down gently, and home-cooked meat, like mutton soup and low-spiced chicken curry, can be included in the diet. Milkshakes and Faloodas can be substituted by turmeric-added milk- which is commonly known in the name of 'golden milk'. It not only builds up your immunity but also helps in the healing of many diseases including wounds.

Having a balanced diet is important, but having them in the proper quantity at the right time is more. If the food is heavy to digest (such as oily food, non-veg, sweets), it should be consumed till half of the satiation level is achieved. If the food is light to digest, it should be consumed till one is not overly satiated. The right amount of food activates digestive fire and undergoes digestion easily. [22]

Conclusion

Junk food is food items that are more than required but are very low in minerals and nutrients that are crucial for the growth and development of human body. Moreover, these foods are high in fat, salt, and sugar. Various studies show that the risk of heart disease is 80% higher in those who are accustomed to such food. Cancer risk is also high for such people. Artificial colors added to food to add flavor and appeal are also a big problem. Sodium benzoate and potassium benzoate, which are added to prevent mold, also belong to this category. Sodium nitrate in processed meats can cause colon cancer. The oil used for frying in restaurants and other places is heated again and again without removing it from the container, which accumulates chemicals and leads to cancer. Gone are the days when sweets were just snacks and now kids are exposed to branded snacks. The secret behind this is the flavoring chemicals. The amount of salt in most packet snacks is also very high which tends to be more palatable. Most of the children are meat lovers. They prefer fried meat like fried chicken. Meat dishes are high in saturated fat. When you constantly eat meat from chickens that are raised with hormone injections, those growth hormones will also be in large quantities in the body leading to precocious puberty and obesity. Monosodium glutamate (MSG) is used as a flavor enhancer in some packaged foods and some restaurant-bought foods. Many processed packaged foods are high in them. Overdosing on MSG, which destroys nerve impulses, can lead to problems ranging from headaches and fatigue to dementia and Parkinson's. It also contains high levels of lead and nitrates. The answer to the

question of what is the best food is simple; Home cooked food. We tend to forget that real natural fast foods are fruits and vegetables that can be cleaned and eaten immediately. The market for packaged beverages is mainly aimed at the current busy world. It is a known fact that many of these are harmful to health and addictive. The answer to the question of what is the best drink for the body is to make it at home. There is no energy drink that beats porridge, buttermilk, lemonade, and tender coconut water.

We may not be able to eliminate Junk-foods, but we can definitely draw a borderline to it. Having a balanced diet must be made the main aim at the dining table. In Ayurveda, food is referred to as the greatest medicine, making us remember the proverb, 'Man is what he eats'. Remembering the words of Ann Wigmore "The food you eat can be either the safest and most powerful form of medicine or the slowest form of poison".

Source of funding: Nil

Conflicts of Interest: Nil

Acknowledgment: Nil

References

1. Critchlow, N., Newberry Le Vay, J., MacKintosh, A. M., Hooper, L., Thomas, C., & Vohra, J. (2020). Adolescents' Reactions to Adverts for Fast-Food and Confectionery Brands That are High in Fat, Salt, and/or Sugar (HFSS), and Possible Implications for Future Research and Regulation: Findings from a Cross-Sectional Survey of 11-19 Year Olds in the United Kingdom. *International journal of environmental research and public health*, 17(5), 1689. <https://doi.org/10.3390/ijerph17051689>
2. Dunford, E. K., Popkin, B., & Ng, S. W. (2022). Junk Food Intake Among Adults in the United States. *The Journal of nutrition*, 152(2), 492–500. <https://doi.org/10.1093/jn/nxab205>
3. Sogari, G., Velez-Argumedo, C., Gómez, M. I., & Mora, C. (2018). College Students and Eating Habits: A Study Using An Ecological Model for Healthy Behavior. *Nutrients*, 10(12), 1823. <https://doi.org/10.3390/nu10121823>
4. Athavale, P., Khadka, N., Roy, S., Mukherjee, P., Chandra Mohan, D., Turton, B. B., & Sokal-Gutierrez, K. (2020). Early Childhood Junk Food Consumption, Severe Dental Caries, and Undernutrition: A Mixed-Methods Study from Mumbai, India. *International journal of environmental research and public health*, 17(22), 8629. <https://doi.org/10.3390/ijerph17228629>
5. Beer, A. L., Becker, M., Frank, S. M., & Greenlee, M. W. (2023). Vestibular and visual brain areas in the medial cortex of the human brain. *Journal of neurophysiology*, 129(4), 948–962. <https://doi.org/10.1152/jn.00431.2022>

6. Bernhardt, A. M., Wilking, C., Adachi-Mejia, A. M., Bergamini, E., Marijnissen, J., & Sargent, J. D. (2013). How television fast food marketing aimed at children compares with adult advertisements. *PloS one*, 8(8), e72479. <https://doi.org/10.1371/journal.pone.0072479>
7. Peleg-Raibstein D. (2021). Understanding the Link Between Maternal Overnutrition, Cardio-Metabolic Dysfunction and Cognitive Aging. *Frontiers in neuroscience*, 15, 645569. <https://doi.org/10.3389/fnins.2021.645569>
8. Ravindra Singh Baghel, Rita Marwaha, Basanti Guru, Shiba Datta Panda, & Arvind Kumar Yadav. (2022). A review of concept of Garbhopaghatakara Bhava in Ayurveda. *Journal of Ayurveda and Integrated Medical Sciences*, 7(3), 86 - 91. Retrieved from <https://jaims.in/jaaims/article/view/1785>
9. Campagnol, P. C., dos Santos, B. A., Terra, N. N., & Pollonio, M. A. (2012). Lysine, disodium guanylate and disodium inosinate as flavor enhancers in low-sodium fermented sausages. *Meat science*, 91(3), 334-338. <https://doi.org/10.1016/j.meatsci.2012.02.012>
10. Mosca, A., De Cosmi, V., Parazzini, F., Raponi, M., Alisi, A., Agostoni, C., & Nobili, V. (2019). The Role of Genetic Predisposition, Programing during Fetal Life, Family Conditions, and Post-natal Diet in the Development of Pediatric Fatty Liver Disease. *The Journal of pediatrics*, 211, 72-77.e4. <https://doi.org/10.1016/j.jpeds.2019.04.018>
11. Shahatah, M. A., Jackarim, A. M., Banjar, R. Z., Kabli, Y. O., Milyani, A. A., & Al-Agha, A. E. (2021). The relationship between body weight and dietary habits with respect to the timing of puberty among saudi children and adolescents. *Annals of African medicine*, 20(3), 193-197. https://doi.org/10.4103/aam.aam_41_20
12. Jayashree K. S. (2008). Maternal care through mainstreaming Ayurvedic approach. *Ancient science of life*, 28(1), 49-54.
13. Calcaterra, V., Verduci, E., Magenes, V. C., Pascuzzi, M. C., Rossi, V., Sangiorgio, A., Bosetti, A., Zuccotti, G., & Mameli, C. (2021). The Role of Pediatric Nutrition as a Modifiable Risk Factor for Precocious Puberty. *Life (Basel, Switzerland)*, 11(12), 1353. <https://doi.org/10.3390/life11121353>
14. Taher, B. M., Ajlouni, H. K., Hamamy, H. A., Shegem, N. S., Madanat, A. Y., & Ajlouni, K. M. (2004). Precocious puberty at an endocrine centre in Jordan. *European journal of clinical investigation*, 34(9), 599-604. <https://doi.org/10.1111/j.1365-2362.2004.01399.x>
15. Vasconcelos, Q. D. J. S., Bachur, T. P. R., & Aragão, G. F. (2021). Whey protein supplementation and its potentially adverse effects on health: a systematic review. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme*, 46(1), 27-33. <https://doi.org/10.1139/apnm-2020-0370>
16. Mueller, N. T., Jacobs, D. R., Jr, MacLehose, R. F., Demerath, E. W., Kelly, S. P., Dreyfus, J. G., & Pereira, M. A. (2015). Consumption of caffeinated and artificially sweetened soft drinks is

- associated with risk of early menarche. *The American journal of clinical nutrition*, 102(3), 648-654. <https://doi.org/10.3945/ajcn.114.100958>
17. Eugster E. A. (2019). Update on Precocious Puberty in Girls. *Journal of pediatric and adolescent gynecology*, 32(5), 455-459. <https://doi.org/10.1016/j.jpag.2019.05.011>
 18. Kota AS, Ejaz S. Precocious Puberty. [Updated 2023 May 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK544313/>
 19. Sabnis M. (2012). Viruddha Ahara: A critical view. *Ayu*, 33(3), 332–336. <https://doi.org/10.4103/0974-8520.108817>
 20. K, S., Sudhakar, & Bhat K, S. (2021). Toxicological evaluation of banana and milk combination as incompatible diet - An experimental exploration of Samyoga viruddha concept. *Journal of Ayurveda and integrative medicine*, 12(3), 427-434. <https://doi.org/10.1016/j.jaim.2021.02.005>
 21. Sharma, M., Kishore, A., Roy, D. et al. A comparison of the Indian diet with the EAT-Lancet reference diet. *BMC Public Health* 20, 812 (2020). <https://doi.org/10.1186/s12889-020-08951-8>
 22. Patwardhan B. (2016). Strengthening the Ayurveda ecosystem. *Journal of Ayurveda and integrative medicine*, 7(2), 73–75. <https://doi.org/10.1016/j.jaim.2016.07.002>.

Chapter: 3**Biomedical Research Ethics: Past, Present and Future****Dr. Tejas A. Acharya****Professor & Head, Department of Pharmacology, C. U. Shah Medical College, Surendranagar,
Gujarat.****Member Secretary, Institutional Ethics Committee (Human Research), CUSMC****E-mail: drtejasacharya@gmail.com**

Abstract: Biomedical research ethics is the study of ethical, social and legal issues arising during health care research. It is important element of medical research. Historically Biomedical research ethics has witnessed many incidences of unethical practices, which paved path for existing Biomedical research ethics practice. Autonomy, beneficence, justice and nonmaleficence are four basic principles of current Biomedical research ethics. All these four principles have aim of protecting basic rights of study participants, which is fulfilled by various modalities like informed consent, randomization, study design and all these modalities are monitored by ethics committee. Future of Biomedical research ethics is bright but involves various challenging issues like stem cell research, gene editing and Artificial Intelligence. Goal of Biomedical research ethics can be fulfilled by Constant alertness of various national and international agencies.

Keywords: Biomedical research, Ethics, Principles of research ethics, Future of ethics

Introduction: Biomedical research ethics is the study of ethical, social and legal issues arising during health care research.^[1] It is part of Biomedical ethics which is relatively broader term and also includes ethics in medical practice. Research ethics is mainly focused on issues during conduction of research. Biomedical research ethics can be considered as one of the important elements in current research trends. It is the backbone for any medical research. Biomedical research ethics has evolved its own path since few centuries and has reached to a stage where it seems like a grown up tree, which still has potential to grow. Nevertheless, journey of evolution of Biomedical research ethics is full of thorns. It is interesting as well as self-explanatory to inspire and teach ethics in current and future medical research.

History of Biomedical research ethics

Considering long history of medical practice in various streams of medicine throughout the history of mankind, there might be incidences which never got noticed. There are few

remarkable episodes, especially in 20th century which left its impact and they were the trigger factors for rise and evolution of Biomedical research ethics.

Edward Jenner – small pox 1796

Edward Jenner inoculated cowpox in to a test subject, who was 8 years old boy and son of his gardener.^[2] Considering misuse of children and slaves as participant of experiments, many ethical experts think this historical incidence was not ethical.^[3]

The monster study - 1939

The monster study was conducted in 1939 by Dr Wendell Johnson in which he experimented on orphanage children without their consent on stuttering and left them under psychological distress.^[4]

Nazi experiments - 1942-45

During Second World War Nazis conducted 359 different experiments on 28655 subjects.^[5] These experiments were out of ethical conducts in current research scenario.

Tuskegee syphilis trial – 1932-72

Tuskegee syphilis study was conducted by US Public Health Services during period of 1932-72 on African men. The ethical issue aroused was that originally study was designed for 6 to 8 months which was extended for 40 years and meanwhile during 1940-50 penicillin was available for treatment of syphilis and it was not made available to participants.^[6]

History of Biomedical research ethical guidelines

Nuremberg code

Nuremberg code was drafted in 1947 in response to Nazi experiments. It laid the foundation of modern research ethical guidelines. Nuremberg code directed 10 points on human experiments which covered important aspects like informed consent and autonomy of participants.^[7]

Declaration of Helsinki

Declaration of Helsinki was prepared by World Medical Association (WMA) in 1964 and since then it has been revised 9 times, latest being done in 2013. It is primarily addressed to physicians and covers many core concepts of human research like risk-benefits, vulnerable groups, ethics committee, informed consent and unproven intervention in clinical practice.^[8]

Belmont report

Belmont report was drafted by The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, USA in 1979. Belmont report was built upon previous guidelines and provided 3 basic principles to guide ethical research: 1) Respect for person, 2) Beneficence and 3) Justice.^[9]

ICH-GCP

International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) Guideline for Good Clinical Practice (GCP) is internationally accepted guidelines for conducting trials. First published in 1996 and revised in 2016 {ICH-GCP E6 (R2)} and recently in May 2023 draft version {ICH-GCP E6 (R3)} of ICH-GCP is released.^[10] ICH-GCP E6(R2) consists of 13 principles and covers all significant aspects of conducting clinical trial.^[11]

Indian Council of Medical Research (ICMR) guidelines

ICMR guidelines are the standard guidelines to be followed in India and were released by ICMR in 2017. The guideline consists of 12 different sections dealing with various areas of research and ethics, amongst which 6 sections are general guidelines, while 6 sections are specific pertaining to specific research areas.^[12]

Current trends in Biomedical research ethics

Current practice in Biomedical research in summation of all the lessons learned in the past and all the efforts mentioned above from various agencies of the world. Collectively 4 principles – autonomy, beneficence, justice and nonmaleficence form the base of current Biomedical research ethics.^[13]

Principles of Biomedical research ethics

Autonomy

Beneficence

Justice

Nonmaleficence

Autonomy

Study participant has total freedom of thought and action while taking decision on participation in the study. He or she can deny not only participation but can also withdraw anytime from the study. This basic fundamental right of research participant requires proper understanding of

study protocol. Participant must be aware of all the benefits and risks involved in the study before participation. Informed consent is the modality which justifies right of autonomy of research participant.

Informed consent is the written document which includes all the details of the study. It should be written or informed in the language which is known to the participant. After explanation participant should be given enough space to ask questions and clear all his/her mental confusions. Informed consent should clearly state that participant can anytime withdraw from the study. Once participant is ready, informed consent should be signed by him or by guardians in case of minor. Some regulatory authorities compulsorily mandates audio visual recording of informed consent explanation and signature taking process.

Beneficence

Beneficence defines ultimate goal of conducting research study. An outcome of research study should be beneficial. Beneficence does not always mean research participants as many a times study may not have direct benefits to research participant. It should be ultimately beneficial to society. For example Phase I studies, which involve healthy participants will not give direct benefits to participants except monitorial benefits, but conducting Phase I trials have ultimately fruitful goal for the society. Conducting study which does not have any benefits does not justify involvement of human participants and their suffering while undergoing study. To protect this basic concept research study should be evaluated not only on scientific parameters, but also on social parameters. This is the reason why each ethics committee has non-scientific members (Lay person, Social scientist, legal expert) as its integral part.

Justice

Justice in research involves various aspects. First is justice in selection. Each and every participant has equal right of selection. Study participation should not be biased based upon race, gender or any other factor. Principle of beneficence would be fulfilled with aid of justice. It becomes more important in types of research where participants will receive different types of treatment. For example in a comparative trial one group of participants receive new drug, while other group of participants receive placebo. To establish efficacy, these types of design can be justified provided that distribution of participants in treatment and non-treatment group is justified. To assure justice in participation randomization is important tool. Randomization is the process of assigning participants to treatment and control groups, assuming that each

participant has an equal chance of being assigned to any group.^[14] It provides equal chance of selection in both the groups.

Second important aspect of justice is justice in getting benefit of treatment. In historical incidences justice was significantly missing. Rich countries carry their experimental trials on poor countries and after completion of trial they would be deprived of treatment. Each country should make laws which rectify this injustice and provide justice in terms of benefits to their trial participants.

Nonmaleficence

Nonmaleficence can be considered as counterpart of beneficence. Research especially which involves more risks are likely to be affected by this principle. Such kind of studies should be weighted for risk benefit analysis. Ethics committee has to play important role to protect this right of participants. If after review ethics committee finds risk is more than benefit, permission to such study should be debated and permission should be granted after thorough analysis.

Confidentiality

Confidentiality is very basic human right and as such it is also integral part of Biomedical research. Each and every information of participants; from identity to data, should be kept confidential. Even at the time of publication it must be taken care that identity of participant does not get revealed. Informed consent should mention confidentiality statement and it should be conveyed to the participant effectively.

Future of Biomedical research ethics

Medical science is ever evolving science. Types of treatment available to patients today are far different and advanced than available in last century. It is obvious that future will have more advanced and different kind of treatment options. As types of treatment will evolve, Biomedical research ethics will also evolve as it will face new questions and dilemmas.

Stem cell research and human gene editing

Stem cell research and human gene editing are already floating ethical issues in Biomedical research. Stem cell research carries issues like maintaining confidentiality of human tissue donors, storage of tissue and preventing manipulation to tissue.^[15] Human gene editing and gene section can raise many ethical issues like chances of mosaicism, off-target effects and some social issues.^[16] Reproductive biology and use of embryos in research are other burning issues.

Artificial Intelligence (AI)

Artificial intelligence (AI), which is currently influencing every field of humanity, has not spared Biomedical research and so ethics as well. Use of AI in clinical practice and research is creating many ethical issues like biases in algorithms and data privacy.^[17] Recently ICMR has released Ethical guidelines for Application of Artificial Intelligence in Biomedical Research and Health care with aim of addressing emerging ethical issues arising while using AI in Biomedical research and Healthcare.^[18] This document provides complete ethics checklist of AI for Biomedical research and healthcare.

Informed consent

Application of dynamic informed consent and meta-consent are example of future evolution of informed consent process. Dynamic consent involves multiple interactions, allows individual to customize their consent the way they want, while meta-consent requires individuals to continue review and revise their consent preference throughout the life course.^[19]

Considering all these scenarios it is obvious that future pathway of Biomedical research ethics is bright as well as full of new challenges.

Summary

Past, present and future possibilities of Biomedical research ethics clearly indicate that it is pivotal pillar of health research. Current and future practice of Biomedical research is not possible without following research ethics. All the fundamental principles which are already laid down must be practiced in each and every concerned Biomedical research. For future it is difficult to predict whether same principles will be enough to protect rights of participants or not. Current organizations working of Biomedical ethics are alert and updated, but still learning from the past, regulatory authorities must be aware that while implementing new modalities, basic human rights must not be forgotten. There must be continues vigilance of regulatory authorities throughout the world regarding evolving nature of research and ethical guidelines must be updated accordingly. Humanity and there rights are ultimate goals of Biomedical research ethics and it is achievable by joining hands for betterment of human society.

References

1. Resnik DB. Bioethics [Internet]. National Institute of Environmental Health Sciences. 2018. Available from: <https://www.niehs.nih.gov/research/resources/bioethics/index.cfm>

2. Davies H. Ethical reflections on Edward Jenner's experimental treatment. *Journal of Medical Ethics*. 2007 Mar 1;33(3):174–6.
3. Ethics - Lessons from Smallpox [Internet]. www.chausa.org. Available from: <https://www.chausa.org/publications/health-progress/archives/article/nurses/ethics---lessons-from-smallpox>
4. Thudium T. The Monster Study [Internet]. Practical Psychology. 2019. Available from: <https://practicalpie.com/the-monster-study/>
5. Weindling P. Painful and sometimes deadly experiments which Nazi doctors carried out on children. *Acta Paediatrica*. 2022 Mar 7;111(9).
6. Paul C, Brookes B. The Rationalization of Unethical Research: Revisionist Accounts of the Tuskegee Syphilis Study and the New Zealand "Unfortunate Experiment." *American Journal of Public Health* [Internet]. 2015 Oct;105(10):e12–9. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4568718/>
7. Nuremberg Code: Directives for Human Experimentation | ORI - The Office of Research Integrity [Internet]. ori.hhs.gov. Available from: <https://ori.hhs.gov/content/chapter-3-The-Protection-of-Human-Subjects-nuremberg-code-directives-human-experimentation>
8. World Medical Association. WMA - the World Medical Association-WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects [Internet]. Wma.net. WMA - the World Medical Association-WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects; 2022. Available from: <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>
9. Miracle VA. The Belmont Report. Dimensions of Critical Care Nursing [Internet]. 2016;35(4):223–8. Available from: https://journals.lww.com/dccjournal/Fulltext/2016/07000/The_Belmont_Report__The_Triple_Crown_of_Research.8.aspx
10. Research C for DE and. E6(R3) GOOD CLINICAL PRACTICE (GCP) [Internet]. U.S. Food and Drug Administration. 2023. Available from: <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/e6r3-good-clinical-practice-gcp>
11. Research P. ICH GCP: Updates to the Guideline for Good Clinical Practice [Internet]. Premier Research. 2018. Available from: <https://premier-research.com/blog-updates-guideline-good-clinical-practice-quick-review/>
12. Mathur R, Thakur K, Hazam R. Highlights of Indian Council of Medical Research National Ethical Guidelines for Biomedical and Health Research Involving Human Participants. *Indian Journal of Pharmacology*. 2019;51(3):214.
13. Avasthi A, Ghosh A, Sarkar S, Grover S. Ethics in Medical research: General Principles with Special Reference to Psychiatry Research. *Indian Journal of Psychiatry*. 2013;55(1):86.

14. Kang M, Ragan BG, Park JH. Issues in Outcomes Research: An Overview of Randomization Techniques for Clinical Trials. *Journal of Athletic Training* [Internet]. 2008 Mar;43(2):215–21. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2267325/>
15. Sipp D, Munsie M, Sugarman J. Emerging stem cell ethics. *Science* [Internet]. 2018 Jun 21;360(6395):1275–5. Available from: <https://science.sciencemag.org/content/360/6395/1275>
16. Rothschild J. Ethical considerations of gene editing and genetic selection. *Journal of General and Family Medicine* [Internet]. 2020 May; 21(3):37–47. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7260159/>
17. Santoro H. The future of ethics and biomedicine: An interview [Internet]. Scope. 2018 [cited 2023 Sep 11]. Available from: <https://scopeblog.stanford.edu/2018/10/23/the-future-of-ethics-and-biomedicine-an-interview/>
18. Ethical guidelines for application of Artificial Intelligence in Biomedical Research and Healthcare | Indian Council of Medical Research | Government of India [Internet]. main.icmr.nic.in. Available from: <https://main.icmr.nic.in/content/ethical-guidelines-application-artificial-intelligence-biomedical-research-and-healthcare>
19. Sheehan M, Thompson R, Fistein J, Davies J, Dunn M, Parker M et al. Authority and future of consent in population –level biomedical research. *Public Health Ethics*. 2019;12(3):225-36.

Chapter: 4**Artificial Intelligence (AI) in Anatomy Education:
Opportunities, Challenges, and Ethical Considerations
Md. Jawed Akhtar¹, Sufia Parveen², Md. Kashif Akhtar^{3*}**

¹Associate Professor, Department of Anatomy, Indira Gandhi Institute of Medical Sciences,
Patna, Bihar (India).

²Junior Resident, Department of Conservative Dentistry and Endodontics, Buddha Institute of
Dental Sciences and Hospital, Patna, Bihar (India)

³Junior Resident, Department of Anaesthesia & Critical Care, Nalanda Medical College and
Hospital, Patna, Bihar (India)

*E-mail: akhtar0912@gmail.com

Abstract: Artificial intelligence (AI) is a transformative technology with the potential to revolutionize anatomy education. This paper explores the key elements of AI, including machine learning, neural networks, deep learning, natural language processing, computer vision, reinforcement learning, and the critical role of data in AI development. Ethical considerations, such as privacy, bias, and societal impact, are also discussed in the context of AI integration. The use of AI in anatomy education offers numerous advantages. Virtual anatomy models provide interactive 3D experiences, personalized learning adapts to individual needs, and diagnostic tools aid in identifying anatomical structures and abnormalities. Virtual dissections and AI-powered voice assistants enhance the learning process. Gamification and data analysis in medical research contribute to a holistic educational experience. Additionally, AI supports remote and online learning, automates assessment and feedback, and ensures accessibility for students with disabilities. The benefits of AI-enhanced assessment and feedback include objective evaluation, efficiency, personalization, immediate feedback, and data-driven insights. Various AI-enhanced assessment methods are presented, such as multiple-choice questions, image recognition, simulation-based assessments, natural language processing, and peer/self-assessment. Challenges in the use of AI in anatomy education encompass accuracy and reliability, data privacy, bias and fairness, accessibility, and resource constraints. Ensuring the correctness of AI-generated content, safeguarding data privacy, mitigating bias, and addressing accessibility issues are essential considerations. Implementing AI in education can be costly, requiring careful planning and investment. Educators and institutions must navigate these challenges to harness AI's full potential while maintaining comprehensive, equitable, and responsible anatomy education.

Keywords: Artificial Intelligence; Anatomy Education; Machine Learning; Personalized Learning; Accuracy and Reliability.

Introduction:

Artificial intelligence, often abbreviated as AI, is a type of technology that makes machines, like computers, robots, or even smartphones capable of doing tasks that typically require human intelligence. These tasks can range from simple things like recognizing patterns in data to more complex tasks such as understanding natural language, making decisions, and even problem-solving. Artificial intelligence has the potential to solve many global healthcare issues including diagnosis, decision-making, data analytics, and administration [1,2]. The following are the key elements of Artificial intelligence [3]:

- A. Machine Learning:** One of the most essential parts of AI is machine learning. It's a subset of AI where machines are trained to learn from data. Think of it like teaching a computer to recognize cats in photos. You'd show it lots of pictures of cats and non-cats, and over time, it would get better at identifying cats on its own. Machine learning algorithms allow computers to improve their performance at a task as they gain more experience and data.
- B. Neural Networks:** Neural networks are a common tool in machine learning. They're inspired by the structure of the human brain and consist of layers of interconnected nodes. Each node processes information and passes it to the next layer. Neural networks are used for tasks like image and speech recognition.
- C. Deep Learning:** Deep learning is a subset of machine learning that uses deep neural networks with many layers (hence "deep"). It's incredibly powerful for tasks like image and speech recognition, natural language processing, and more. Deep learning has enabled breakthroughs in various AI applications.
- D. Natural Language Processing (NLP):** NLP is a branch of AI that focuses on enabling computers to understand, interpret, and generate human language. It's what powers voice assistants like Siri and chatbots that can have conversations with you.
- E. Computer Vision:** Computer vision is another crucial area of AI that allows computers to "see" and interpret visual information. This technology is used in self-driving cars, facial recognition, and many other applications.
- F. Reinforcement Learning:** This is a type of machine learning where an AI agent learns to make decisions by interacting with an environment. It learns by trial and error,

receiving rewards or penalties based on its actions. It's used in robotics and game playing.

G. Data and Big Data: AI heavily relies on data. The more data an AI system has access to, the better it can learn and perform tasks. Big Data refers to the massive amounts of data collected and analyzed to train AI systems.

H. Ethical Considerations: As AI becomes more advanced and integrated into our lives, there are important ethical questions to address, such as privacy concerns, bias in AI algorithms, and the impact on jobs and society.

In simple terms, AI is about making computers smarter by teaching them to learn from data and perform tasks that normally require human intelligence. It's an exciting field with the potential to revolutionize industries and improve our daily lives, but it also comes with challenges that we need to address as it continues to evolve.

AI has already brought numerous benefits to several fields of medicine. For instance, it has been successfully used for the detection of conditions such as atrial fibrillation, epilepsy seizures, and hypoglycaemia, as well as for diagnosing diseases through histopathological examination and medical imaging [4]. It is important to note that the use of AI is not limited to radiology or pathology, as it can be highly beneficial for image recognition in various fields, including primary care practice and urgent surgical decisions. Recent data highlights that every specialty in medicine is currently exploring the use of AI to assist medical professionals [5].

Use of Artificial Intelligence in Human Anatomy Education:

Artificial Intelligence (AI) has the potential to greatly enhance human anatomy education in various ways:

A. Virtual Anatomy Models: AI can create highly detailed, interactive, and 3D virtual models of the human body. Anatomy educators took part in the utilization of the advancement in 3D printing technology. 3D printed anatomical models have become a valuable addition to anatomy labs as a teaching resource, supplementing traditional methods such as dissection, and commercially available anatomical models [16]. With the increased availability and continuously decreasing cost of 3D printers, this technology is expected to become more widely adopted in anatomical teaching. These models are particularly useful for teaching small anatomical structures, which require

more detailed illustrations, as well as for illustrating anomalies and simulating surgical procedures [17–19].

- B. Personalized Learning:** AI-powered educational platforms can adapt to individual student's needs. They can assess a student's level of knowledge and tailor lessons and quizzes accordingly. This ensures that each student progresses at their own pace and focuses on areas where they need improvement.
- C. Diagnostic Tools:** AI can be used to develop diagnostic tools that help students identify anatomical structures and abnormalities [10]. For example, AI can assist in the interpretation of medical imaging like X-rays and MRIs, providing real-time feedback to students and helping them develop diagnostic skills.
- D. Virtual Dissections:** Instead of using real cadavers for dissection, which can be expensive and ethically challenging, AI can simulate virtual dissections. Students can practice procedures and surgeries in a risk-free virtual environment. In a manner similar to actual dissection sessions, the students can undertake virtual dissection by removing layers or particular body parts. The anatomage table is the most typical illustration of this group of cutting-edge teaching strategies for anatomy [11,12]. With the use of this technology, students can digitally dissect a full-sized male and female human cadaver on a tablet. When utilized as a supplement to actual dissection, it was discovered to motivate students to understand anatomy. For some anatomical subjects, such as musculoskeletal anatomy, it was also stated that it was similar to actual dissection [13].
- E. Voice and Chatbot Assistants:** AI-powered voice assistants and chatbots can answer students' questions about anatomy, provide explanations, and offer guidance. This can be especially helpful for self-paced learning or remote education.
- F. Gamification:** AI can be used to create educational games that make learning anatomy fun and engaging. Gamification can motivate students to explore the human body and learn about its complexities.
- G. Data Analysis and Research:** In the field of medical research, AI can analyze vast amounts of medical data, assisting in the discovery of new anatomical insights and potential treatment options. This research can then be incorporated into educational materials.
- H. Remote and Online Learning:** AI can support remote and online anatomy education by providing realistic and interactive experiences for students who are not physically present in a traditional classroom or laboratory.

- I. Assessment and Feedback:** AI can automate the grading of assignments and assessments, providing instant feedback to students. It can also help educators identify areas where students commonly struggle and adjust teaching methods accordingly [14-16].

Benefits of AI-Enhanced Assessment and Feedback:

- **Objective Evaluation:** AI provides standardized and impartial assessment, reducing subjective biases in grading.
- **Efficiency:** Automated assessment tools save educators time and allow for faster feedback delivery to students.
- **Personalization:** AI analyzes individual performance data to tailor feedback and suggest areas for improvement based on each student's needs.
- **Immediate Feedback:** Students receive instant feedback, promoting active learning and rapid correction of misconceptions.
- **Data-Driven Insights:** AI generates actionable insights about class performance, enabling educators to adjust teaching strategies and content.

Types of AI-Enhanced Assessment and Feedback in Anatomy Education:

- **Multiple-choice and Objective Questions:** AI systems can grade multiple-choice exams and quizzes accurately, providing immediate scores.
 - **Image Recognition:** AI identifies and evaluates anatomical structures in medical images, aiding in radiology and diagnostic training.
 - **Simulation-Based Assessments:** Virtual anatomy simulations with AI feedback help students practice procedures, such as surgeries or dissections.
 - **Natural Language Processing (NLP):** NLP algorithms assess written assignments and essays, offering feedback on anatomy-related explanations and terminology.
 - **Peer and Self-Assessment:** AI assists in peer and self-assessment by providing rubrics and guidelines, ensuring consistency in evaluations.
- J. Accessibility:** AI can make anatomy education more accessible to individuals with disabilities. For example, it can provide alternative ways of accessing educational materials, such as through voice commands or tactile feedback for visually impaired students.

While AI has the potential to revolutionize anatomy education, it's essential to consider ethical and privacy concerns, ensure the accuracy of AI models, and maintain a balance between technology and human instruction to provide a comprehensive and effective learning

experience. Additionally, educators and institutions should stay updated with the latest advancements in AI to make informed decisions about integrating it into their curricula.

Challenges in the use of AI in Anatomy Education [17]:

- A. Accuracy and Reliability:** AI tools used in anatomy education must provide accurate information and simulations. Ensuring the correctness of AI-generated content can be challenging and may require constant validation.
- B. Data Privacy:** AI systems often rely on vast amounts of data, including medical images and patient records. Safeguarding the privacy and security of this data is crucial, as breaches can have serious consequences.
- C. Bias and Fairness:** AI models can inherit biases present in the data they are trained on. In anatomy education, this could result in biased representations of human anatomy or health disparities. Efforts must be made to identify and mitigate bias.
- D. Accessibility:** Making AI-based education accessible to all students can be challenging. Some students may lack access to the required technology or may have disabilities that affect their ability to use AI tools effectively.
- E. Resource Constraints:** Implementing AI in education can be costly, both in terms of technology infrastructure and training educators to use AI effectively. Smaller institutions or those with limited resources may face difficulties in adopting these technologies.

Ethical Considerations in the Use of AI in Anatomy Education [18,19]:

- A. Patient Data Consent:** When AI systems use patient data for educational purposes, obtaining informed consent is critical. Patients should be aware of how their data is being used and have the option to opt-out.
- B. Transparency:** AI algorithms can be complex, making it difficult for educators and students to understand how they arrive at specific conclusions. Transparency in AI is essential to maintain trust and ensure ethical use.
- C. Student Consent and Data Usage:** Students should be informed about the use of AI in their education, how their data is collected and used, and the potential implications for their privacy.
- D. Inclusivity and Equity:** Efforts should be made to ensure that AI anatomy education is inclusive and equitable. This includes addressing disparities in access to technology and resources and considering diverse cultural and linguistic backgrounds.

- E. Continuous Monitoring and Evaluation:** Educators and institutions should continuously monitor and evaluate the effectiveness and ethical implications of AI in anatomy education. Adjustments should be made as needed to address emerging ethical concerns.
- F. Professional Ethics:** Healthcare professionals who use AI in their education should adhere to ethical guidelines when applying this knowledge to patient care. Ethical considerations must remain at the forefront of medical practice.
- G. Accuracy and Bias Mitigation:** AI systems should be regularly tested for accuracy, and steps should be taken to mitigate biases in AI-generated content. This includes addressing any inaccuracies or biases related to anatomical representations.

Conclusions:

The integration of artificial intelligence (AI) into anatomy education holds immense promise for transforming the way students learn about the complexities of the human body. AI technologies offer a range of benefits, including immersive and personalized learning experiences, enhanced accessibility, and cost efficiency. However, they also present a set of challenges and ethical considerations, such as the need for accuracy, the importance of data privacy, and the requirement for inclusivity and transparency. Educators and institutions must carefully navigate these challenges to harness the full potential of AI while upholding ethical standards and ensuring that anatomy education remains a comprehensive, equitable, and responsible endeavor. As AI continues to advance and evolve, its role in anatomy education is likely to grow, requiring ongoing efforts to strike the right balance between innovation and ethical practice in medical education.

References:

1. Chen J. Playing to our human strengths to prepare medical students for the future. *Korean J Med Educ* 2017 Oct; 29(3):193-197.
2. Meskó B, Hetényi G, Györffy Z. Will artificial intelligence solve the human resource crisis in healthcare? *BMC Health Serv Res* 2018 Jul 13; 18(1):545.
3. M. Taddy. The Technological Elements of Artificial Intelligence A. Agrawal, J. Gans, A. Goldfarb (Eds.), *The Economics of Artificial Intelligence: An Agenda*, The University of Chicago Press, Chicago 2019;61-87.
4. Briganti G, Le Moine O. Artificial Intelligence in Medicine: Today and Tomorrow. *Front Med (Lausanne)* 2020 Feb 5; 7:27.
5. Mesko B, Gorog M. A short guide for medical professionals in the era of artificial intelligence. *NPJ Digit Med* 2020 Sep 24; 3(1):126.
6. McMenamin, P.G.; Quayle, M.R.; McHenry, C.R.; Adams, J.W. The production of anatomical teaching resources using three-dimensional (3D) printing technology. *Anat. Sci. Educ.* 2014; 7:479-486.
7. Jaksa, L.; Pahr, D.; Kronreif, G.; Lorenz, A. Development of a Multi-Material 3D Printer for Functional Anatomic Models. *Int. J. Bioprint.* 2021; 7:420.
8. Vatankhah, R.; Emadzadeh, A.; Nekooei, S.; Yousefi, B.T.; Rezaiyan, M.K.; Moonaghi, H.K.; Razavi, M.E. 3D Printed Models for Teaching Orbital Anatomy, Anomalies and Fractures. *J. Ophthalmic. Vis. Res.* 2021; 16:611-619.
9. Yuan, Z.M.; Zhang, X.D.; Wu, S.W.; Nian, Z.Z.; Liao, J.; Lin, W.; Zhuang, L.M. A simple and convenient 3D printed temporal bone model for drilling simulating surgery. *Acta. Otolaryngol.* 2021; 142:19-22.
10. Banerjee, A. Chakraborty, C. Kumar, A. Biswas, D. Emerging trends in IoT and big data analytics for biomedical and health care technologies. In *Handbook of Data Science Approaches for Biomedical Engineering*, 1st ed.; Balas, V.E., Solanki, V.K., Kumar, R., Khari, M., Eds.; Academic Press: London, U. 2020; 121-152.
11. Primal Pictures. The Leading 3D Anatomy Resource. 2022. Available online: <https://www.primalpictures.com/> (accessed on 11 September 2023).
12. Interact Elsevier. Netter's 3D Interactive Anatomy. 2022. Available online: <https://netter3danatomy.com/> (accessed on 11 September 2023).
13. Anatomage Inc. Anatomage Table. 2022. Available online: <https://www.anatomage.com/table/> (accessed on 11 September 2023).
14. Dannefer, E.F. Beyond assessment of learning toward assessment for learning: Educating tomorrow's physicians. *Med. Teach.* 2013; 35:560-563.
15. Hift, R.J. Should essays and other "open-ended"-type questions retain a place in written summative assessment in clinical medicine? *BMC Med. Educ.* 2014; 14:249.

16. Choudhury, B.; Freemont, A. Assessment of anatomical knowledge: Approaches taken by higher education institutions. *Clin. Anat.* 2017; 30:290-299.
17. Chan KS, Zary N. Applications and challenges of implementing artificial intelligence in medical education: integrative review. *JMIR medical education.* 2019 Jun 14;5(1):e13930.
18. Char DS, Shah NH, Magnus D. Implementing machine learning in health care - Addressing ethical challenges. *N Engl J Med* 2018; 378:981-3.
19. Goldhahn J, Rampton V, Spinass GA. Could artificial intelligence make doctors obsolete? *BMJ* 2018; 363:k4563.

Chapter: 5
Early (Short-Term) Side-Effects of Chemotherapy in Pediatric Solid Tumors
Dr. Geetika Mathur
E-mail: drgeetikamathur02@gmail.com

Abstract: The pediatric solid tumors are being diagnosed timely due to increased awareness and utility of radiological investigations. The treatment modalities are chemotherapy, surgery and radiotherapy in one or more combinations. Each modality has its own side-effects. Neuroblastoma and Wilms' tumor were most common. The mortality rate was 23.4% and most of them due to neutropenia. Nutritional assessment showed severe thinness in 61.8% ($BMI < 16 \text{ kg/m}^2$). Among side-effects at follow ups, fall in TLC, platelet count and alopecia were significant ($p < 0.05$). Nausea, vomiting, alopecia and constipation were most frequent side-effects in all the regimens. According to modified Hartwig Siegel scale, majority of side-effect were of grade-5. Conclusion- By careful monitoring of side-effects, incidence of morbidity and mortality can be decreased.

Keyword: side-effects, chemotherapy, malignancy.

Introduction

The best strategy for fighting cancer is prevention-i.e., making changes in lifestyle to lower cancer risk. Nonetheless, even if one applies all that he/she knows about preventing cancer, one out of four people would still suffer from cancer. Malignancy in children is very rare with an occurrence of 140-155 per 10,00,000 per year (age < 15 years).¹ Cancer is progressively becoming a cause of death of children aged between 1 to 14 years; also the likelihood of cancer has on an average increased up to 1.0% every year.²

The aim of chemotherapy is to be as helpful as possible with bearable side effects, since the dose of the chemotherapy will be lethal to the cancer cells as well as to the normal cell. Acute side effects common to several anticancer drugs include myelosuppression, nausea, vomiting, alopecia, oro-intestinal mucositis, liver function abnormalities, allergic oro-cutaneous reactions and local ulceration from hypodermic drug extravasation. These acute side-effects occur hour to weeks after a dose and are usually reversible.

Early side effects that comprises acute which develop within 24 hours and delayed which

develops after 24 hours and up to 6 - 8 weeks after chemotherapy treatment in pediatric solid malignancy.

Chapter Content

Most of the studies in literature are retrospective in nature, with focus on distribution of pediatric solid tumors and side-effects of chemotherapy.^{4,5,6}, as **Sharma PK et al⁷ (2017)** study.

Literature reviews various scales to assess severity of drug reactions and side-effects of chemotherapy. **Surendiran A et al⁸ (2010)**, **Sharma A et al⁵ (2015)** and **Sharma PK et al¹¹(2017)** used modified Hartwig and Siegel scale and modified Schumock and Thornton scale respectively to assess the severity and preventability of the reported reactions. **Qureshi SS et al⁹ (2018)**, **Sharma N et al¹⁰ (2017)**, **Sharma PK et al¹¹ (2017)** studied pediatric age group cases.

WHO has defined nutritional assessment by weight for height, height for age and weight for age. **Illias Tazi et al¹³** reported the incidence of malnutrition ranged from 20-50%. **Mukhopadhyay et al¹⁴** and **Kumar R et al¹⁵** found a prevalence of malnutrition as 16.9% and 52% respectively in their studies.

Sharma N et al¹⁰ (2017) reported neuroblastoma as most common tumor in age group of 2-11 years (60%) followed by infants up to 23 months (27%), while Wilms' tumor was most frequent in age group 1-5 year (25.0%).

Regimen wise distribution of side effects

There are various chemotherapeutic regimens for different pediatric solid tumors. **Apte AV et al¹⁶** studied the side-effects in intravenous chemotherapeutic drugs and found that hair loss was seen in 80 % cases while nausea, vomiting and anorexia were observed in 50%; thrombophlebitis, fever, urticaria and decreased leukocyte count were present in 40%. **Beniwal R et al¹⁷ (2019)** reported the fixed drug eruption as commonest pattern of cutaneous side-effects.

A level of severity of side effects was recorded according to guidelines prepared by National Cancer Institute-Common Toxicity Criteria and Modified Hartwig and Siegel Scale.

Chemotherapy induced Nausea and Vomiting

Hesketh PJ¹⁸ (2008), **Singh S et al¹²** reported the incidence of chemotherapy-induced nausea & vomiting (CINV) as 25.0%-100.0%, 47%. Same author in 2003 reported that patients

receiving prophylactic ondansetron and dexamethasone for the prevention of CINV tolerated side effects of nausea & vomiting well.

Chemotherapy induced Alopecia

Singh S et al¹² (2017) and **Trüeb RM et al¹⁹** reported alopecia as the most common side-effect seen in 81.5% and 30- 78% individual. Chemotherapeutic induced alopecia carries lot of anxiety and distress as much as other skin conditions. CIA is considered one of the most traumatic factors in cancer patient care, Also, in school-aged children and teenagers, alopecia may result in reduced social interaction.

Chemotherapy induced GI Toxicities

Abernethy AP et al²⁰ reported that constipation occurred in 50.0-87.0% of advanced cancer patients similarly **Yamagishi A et al²¹** and **Anthony LB²²** reported constipation as the third most common symptom with an overall prevalence of 16.0%. Chemotherapy-induced diarrhea and CIC are amongst the most common chemotherapy-induced GI toxicities, heavily contributing to treatment delays, dose reductions and in some cases cessation of anti-cancer treatment, greatly effecting management and clinical outcomes.

Anorexia

Eating disorder is one of the most common health problems with clinical and psychological consequences, which can affect body image in cancer patients. **Hossein SA et al²³** reported anorexia in 29.0% cases.

Oral Ulceration

Oral Ulceration was found to be in 29.4% cases in **Gandhi et al (2017)**, on 62 children in their study on prevalence of the oral complications happening in a population of pediatric cancer patients going through chemotherapy, oral mucosal ulcer and mucositis were the most frequent side effects of chemotherapy. Out of 62 subjects 36 subjects had oral mucositis, ulcer were seen in 31 children and are tend to appear 5-10 days after the start of chemotherapy.

Taste Alteration

The sense of taste is responsible for the detection and ingestion of food to cover energetic requirements in health and disease. The change in taste perception might lead to malnutrition that is usually one of the frequent causes of morbidity and mortality in patients with cancer **Zabernigg et al²⁴** and **Skolin I et al** conducted study and reported taste alterations in 69.9%,

and a significant association was found between taste alterations and a change in patient's quality of life such as appetite and fatigue.

Febrile Neutropenia

Mohammed HB et al²⁵ 73 (54.0%) and **Biswal S & Godnaik CJE, Llamas RMH et al²⁶** performed a study in Pakistan and showed that the most frequent side effect was the FN episodes (72.1%). Febrile neutropenia (FN) is an oral temperature of $> 38.3^{\circ}\text{C}$ or two consecutive readings of $> 38.0^{\circ}\text{C}$ for 2 h and an absolute neutrophil count (ANC) of $< 0.5 \times 10^9/\text{l}$, or expected to fall below $0.5 \times 10^9/\text{l}$. In cancer patients, it is a serious, potentially fatal condition complicating cancer treatment associated with significant morbidity and mortality and common reasons for hospital admission in children with cancer. Factors which contribute to occurrence of FN in pediatric cancer patients include age of child, duration of neutropenia, ANC value, comorbidities, type of cancer and its stage, complication of chemotherapy, identified pathogens, the severity of vital sign.

Ototoxicities

Subjects with exposure to ototoxic medications had significantly increased risk for developing ringing in ears. **Dille MF et al²⁷** in 47.0%, Fossa S et al 28 in their study reported that cisplatin treatment for testicular cancer causing tinnitus in 20-25% of cancer survivor.

Age wise distribution of severe side effects

According to various research, ringing in ears was observed in 1 out of 4 cases, Vomiting in 1 out of 2 (50.0%) cases and Neutropenia in 5 out of 13 (38.5%) as the severe clinical side effects in the age group of ≤ 1 year. In age group 1-5 years major clinical side effects were Nausea, Alopecia, Anorexia, Musculoskeletal Pain -1/1 (100%), Fever 4/4 (100.0%), Increased Breathing efforts and Hearing Loss - 1/1 (100.0%) followed by Neutropenia 7/13 (53.8%) and Weakness 1/2 (50.0%). Weakness (50.0%) and also Neutropenia 1/13 (7.7%) was the severe clinical side effect in age group > 5 years children.

Mortality during chemo:

The rate of mortality was 23.4%. **Sharma N et al¹⁰ (2017)** studied 303 pediatric cancer patients and found that 33.9% went into remission, 35.64% were defaulters, 2.97% had stable disease, 2.31% had partial response, 3.96% were still on treatment, and 20.79% expired.

Sharma N et al¹⁰ (2017) reported in his study that 53% Neuroblastoma , PNET/ES 19%, Wilms' tumor 11.1% patients expired. The highest survival was seen for Wilms' tumor and Hodgkins' lymphoma. The survival for retinoblastoma and germ cell tumors, was disappointingly low in our research, most common primary tumor with mortality were Wilms' Tumor and neuroblastoma.

Causes of mortality:

Highest mortality in children were due to Neutropenia (54.5%) and Thrombocytopenia (36.4%) were the main causes of death followed by Leukopenia 2 (18.2%) which was consistent with **Sharma N et al¹⁰ (2017)**.

Conclusion

- ❖ The male children were 58.8% indicating the male predominance.
- ❖ The majority of children were of the age group >1-5 years (47.1%).
- ❖ Neuroblastoma was most frequent (41.7%) in age group ≤ 1 year.
- ❖ Wilm's Tumor was most frequent (25.0%) in age group >1- 5 years.
- ❖ 61.8% children shows the BMI $<16.0 \text{ kg/m}^2$.
- ❖ The majority of children were given ST.JUDE'S Regimen (23.5%) followed by PEB Regimen (20.6%), DD4A Regimen and VAC Regimen with 17.6% each.
- ❖ TLC and Platelet were significantly decreased ($P<0.05$) biochemical parameters at different follow-up.
- ❖ Only Alopecia was significantly ($P<0.05$) associated with the increase in the severity during follow-up.
- ❖ Mortality rate of the present study was 23.4%.
- ❖ Neutropenia 45.5% and Thrombocytopenia 45.5% were the main causes of death.
- ❖ Wilm's Tumor 28.6% and Neuroblastoma 25.0% were the main tumor in death cases.
- ❖ Nausea, vomiting, alopecia, and constipation were the most frequently occurring side effects in almost all the regimen used.
- ❖ Neutropenia was the only severe side effect that occurs in almost all the regimens given.
- ❖ Majority of the severe clinical side effects were shown in grade-5; only Neutropenia shows in grade-6 and grade-7 also.

Due to lack of pharmacovigilance it is an obligate matter for all clinicians to follow up all the cancer patients who receive chemotherapy in order to prevent or palliate any of these side effects which may appear.

References

1. Saletta F, Seng MS, Lau LMS. Advances in paediatric cancer treatment. *Transl Pediatr.* 2014; 3(2):156-82
2. Shochat SJ, Fremgen AM, Murphy SB, Hutchison C, Donaldson SS, Haase GM, Provisor AJ, Clive-Bumpus RE, Winchester DP. Childhood cancer: patterns of protocol participation in a national survey. *CA: a cancer journal for clinicians.* 2001 Mar; 51(2):119-30.
3. Cokkinides V, Albano J, Samuels A, Ward M, Thum J. American cancer society: Cancer facts and figures. *Atlanta: American Cancer Society.* 2005; 2017.
4. Saini VK, Sewal RK, Ahmad Y, Medhi B. Prospective Observational Study Of Adverse Drug Reactions of Anticancer Drugs Used in Cancer Treatment in a Tertiary Care Hospital. *Indian Journal of Pharmaceutical Sciences.* 2015; 77(6):687-93
5. Sharma A, Kumari KM, Manohar HD, Bairy KL, Thomas J. Pattern of Adverse Drug Reactions Due To Cancer Chemotherapy in a Tertiary Care Hospital in South India; *Percept Clin Res.* 2015;(6): 109-15
6. Hartwig SC, Siegel J, Schneider PJ. Preventability and severity assessment in reporting adverse drug reactions. *Am J Hosp Pharm* 1992; 49:2229-32.
7. Sharma PK, Misra AK, Gupta N, Khera D, Gupta A, Khera P. Pediatric pharmacovigilance in an institute of national importance: Journey has just begun. *Indian J Pharmacol.* 2017; 49(5): 390-95. .
8. Surendiran A, Balamurugan N, Gunaseelan K, Akhtar S, Reddy KS, Adithan C. Adverse drug reaction profile of cisplatin-based chemotherapy regimen in a tertiary care hospital in India: An evaluative study. *Indian J Pharmacol.* 2010; 42(1):40-3. .
9. Qureshi SS, Bhagat MG, Kembhavi SA, Chinnaswamy G, Vora T, Prasad M, Laskar S, Khanna N, Ramadwar MR, Shah S, Salins N. A cross-sectional study of the distribution of pediatric solid tumors at an Indian tertiary cancer center. *Indian journal of cancer.* 2018 Jan 1; 55(1): 55-60.
10. Sharma N, Ahmad A, and Bhat NA. Indian Journal of Medical and Paediatric Oncology: Official Journal of Indian Society of Medical & Paediatric Oncology. *Indian J Med Paediatr Oncol.* 2017; 38(4): 471-7.
11. Sharma PK, Misra AK, Gupta N, Khera D, Gupta A, Khera P. Pediatric pharmacovigilance in an institute of national importance: Journey has just begun. *Indian J Pharmacol.* 2017; 49(5): 390-95.
12. Singh S, Dhasmana DC, Bisht M, Singh K.P. Pattern of Adverse Drug Reactions to Anticancer Drugs: A Quantitative and Qualitative Analysis. *Indian Journal of Medical and Paediatric Oncology.* 2017; 38 (2):140-45.
13. Illias Tazi, Zakia Hidane, Saadia Zafad, Mhamed Harif, Said Bencheikroun, and Raul Ribeiro. Nutritional Status at Diagnosis of Children with Malignancies in Casablanca. *Pediatr Blood Cancer.* 2008 Oct; 51(4): 495–498.

14. Mukhopadhyay A, Shawgi S, Mohite U, Mukhopadhyay S, et al. Impact of treatment outcome in acute lymphoblastic leukemia of childhood. In: Marwaha RK, editor. Abstract book of Phocon. Chandigarh: 1998. p. 5.
15. Kumar R, Marwaha RK, Bhalla AK, Gulati M. Protein energy malnutrition and skeletal muscle wasting in childhood acute lymphoblastic leukemia. *Indian Pediatr.* 2000; 37:720–726.
16. Apte A V, Kumar V, Sharma SP, Arora NC, Gangopadhyay AN, Gupta DK, et al. How safe and effective is pre-operative intra tumoral chemotherapy in advanced inoperable pediatric solid malignancies? *J Indian Association Pediatric Surgery.* 2001; (6):119-24.
17. Beniwal R, Gupta LK, Khare AK, Mittal A, Mehta S, Balai M. Clinical profile and comparison of causality assessment tools in cutaneous adverse drug reactions. *Indian Dermatol Online J* 2019; 10:27-33.
18. Hesketh PJ. Chemotherapy-induced nausea and vomiting. *N Engl J Med* 2008; 358:2482-94.
19. Trüeb RM. Chemotherapy-induced alopecia. *Semin Cutan Med Surg* 2009; 28:11-4.
20. Abernethy AP, Wheeler JL, and Zafar SY. Detailing of gastrointestinal symptoms in cancer patients with advanced disease: new methodologies, new insights, and a proposed approach. *Curr. Opin. Support. Palliat. Care* 2009; 3:41–49.
21. Yamagishi A, Morita T, Miyashita M, and Kimura F. Symptom prevalence and longitudinal follow-up in cancer outpatients receiving chemotherapy. *J. Pain Symptom Manage.* 2009; 37:823–830.
22. Anthony LB. “Diarrhea, constipation, and obstruction in cancer management,” in *The MASCC Textbook of Cancer Supportive Care and Survivorship*, ed. N. Ian Olver (Berlin: Springer), 2010; 249–260.
23. Hossein SA, Bahrami M, Mohamadirizi S, and Paknaad Z. Investigation of eating disorders in cancer patients and its relevance with body image. *Iran J Nurs Midwifery Res.* 2015 May-Jun; 20(3): 327–333.
24. Zabernigg A, Gamper E-M, Giesinger JM, Rumpold G, Kemmler G, Gatringer K, et al. Taste alterations in cancer patients receiving chemotherapy: a neglected side effect? *Oncologist* 2010; 15: 913–920.
25. Mohammed HB, Yismaw MB, Fentie AM and Tadesse TA. Febrile neutropenia management in pediatric cancer patients at Ethiopian Tertiary Care Teaching Hospital. *BMC Res Notes* 2019; 2019:12:528.
26. Llamas RMH, Acosta MEH, Silva JD. Management of febrile neutropenia in pediatric cancer patients. *J Pediatr Neonatal Care.* 2019; 9(1):22–6.
27. Dille MF, Konrad-Martin D, Gallun F, Helt WJ, Gordon JS, Reavis KM, et al. Tinnitus Onset Rates from Chemotherapeutic Agents and Ototoxic Antibiotics: Results of a Large Prospective Study. *J Am Acad Audiol* 21:409-417 (2010)

28. Fossa S, de Wit R, Roberts J, et al. Quality of life in good prognosis patients with metastatic germ cell cancer: a prospective study of the European organization for research and treatment of cancer genitourinary group/medical research council testicular cancer study group (30941/TE20). *J Clin Oncol* 2003; 21(6):1107-1118.

Chapter: 6
Health and Pollution in Banbishnupur village, Haldia, West Bengal
Soma Rani Karan
Assistant Professor, Department of Economics
Shahid Matangini Hazra Government General Degree College for women
Purba Medinipur, West Bengal
E-mail: somaranikaran@gmail.com

Abstract: Environment and health are inextricably interlinked. The physical environment, such as drinking water, sanitation, housing and air has considerable effects on health status and well-being of people. The present cross-section study has been conducted among Scheduled and General Caste population of Banbishnupur. Banbishnupur village situated in the Word No-17, under Haldia Municipality, Purba Medinipur District of West Bengal. . I have conducted my survey on health and pollution among 39 households distributed in 3 hamlets of the village Banbishnupur. The objectives of the present study are to explore the health status and perceived environmental pollution of the study participants. . Majority of the study participants belong to normal BMI values. Prevalence of overweight/obesity is more than the underweight prevalence among the study groups. Present study participants identified two major pollution related problems i.e. water pollution air pollution in the locality. Majority of the participant believe that water pollution is the most severe in the locality, while some other participants believe that air pollution is the most severe. Study participants also give some suggestion to overcome from the water pollution related problems, especially for health ecology of the pond

Keywords: Environment, health, pollution.

Introduction:

Environment and health are inextricably interlinked. The physical environment, such as drinking water, sanitation, housing and air has considerable effects on health status and well-being of people. Environmental change and its attendant health impacts are driven by many factors, including economic growth, population growth and movements. The three broad trends- the intensification of agriculture, industrialization and rising energy us-which stand out in terms of their profound impacts on the physical environment and their enormous potential for influencing human health. Rapid urbanization and the uncontrolled growth of urban slums are now creating double environmental health burden for the urban poor. In India, premature death and illness due to major environment health risks accounts for nearly 20 percent of the

total burden of disease in India. Proper environmental management is the key to avoiding the quarter of all preventable illness which are directly caused by environmental factors. There is an immediate need to tackle environmental health issues. Problems such as unsafe water, sanitation and hygiene and air pollution are major contributors to the worldwide disease burden.

Studies reported that due to economic and population growth, environmental pollution is a significant issue in Asia. Many health impacts from environmental pollution have been reported. Air pollution has been shown to be associated with lung cancer, lung function, respiratory problems and cardiovascular disease. Water pollution has been linked to water-borne diseases and chemical poisoning. Noise pollution, in turn, is likely to increase the risks of cardiovascular disease, sleep disturbance, stress and hearing impairment.

In an ecological study, based on the household survey on health and pollution in the village Banbishnupur were investigated. Societies are not homogeneous and individuals of every society develop distinct social and cultural values. Population totals and structures changes time to time and this may have an impact on health of the individuals. There are close links between the social environment and the health of the community.

Study objectives:

In view of the above, present study aims to explore the following objectives:

- I. What is the health status of the study group?
- II. What is the perception about pollution of the study group?

Study Area and Study Participants:

The present community based cross-sectional study has been conducted among individuals belonging to a scheduled and General Caste population of Banbishnupur. Banbishnupur village is situated in the Ward No-17, under Haldia Municipality Block, Post-Balughata and Purba Medinipur District of West Bengal. The Haldia Municipality area covered by 109.89 sq.km. It is a major sea port and industrial town, located approximately 10 kilometres from state capital Kolkata. The Haldia industrial belt is well connected by all modes of surface transport like road, rail and waterways. Two important rivers, namely Hooghly and Haldia, of the state influence the geo- climatic condition of the area.

Banbishnupur village consists of a large number of caste populations which distributed in eight hamlets/paras i.e. with a population of more than 4000 individuals. The data were collected on

2nd March.2023. The subjects were included without any sampling method. In the first stage, I have selected 3 hamlets/paras and then I approached every household located in the locality. The households/individuals voluntarily participated in the study were selected as study participants.

Anthropometric Measurements:

Anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body. It reflects both health and nutritional status and predicts performance, health and survival. Anthropometric measurements were recorded following standard procedures. Weight was recorded to the nearest 0.5 kg with the participant standing motionless on a portable weighing scale. The measurement was taken wearing minimum clothing without any footwear. Height was measured to the nearest 0.1 cm with the participant standing in erect position on a flat platform with the head oriented in the Frankfort horizontal plane using an anthropometric rod. The instruments used were calibrated before and during the period of data collection to reduce the systematic error.

The Body Mass Index (BMI) has been computed using the formula as follows:

Body Mass Index (BMI)(kg/m²) = Weight(kg)/stature(m²).

Classification of data:

Health status was assessed with standard cut-off values of Body Mass Index (BMI) to classify underweight (< 18.50kg/m²), normal (18.50-24.99 kg/m²), overweight (25.00-29.99 kg/m²) and obese (≥30.00 kg/m²) in adults (WHO 2004). Reported health status was also been assessed in terms of morbid condition of the participants during three months period to field survey.

Results

Health Status:

Health is an essential component for human survival and it is not only a state of well-being but also a resource for everyday life. World Health Organization (WHO, 1948) DEFINE 'Health' as a state complete physical, mental and social well-being and not merely the absence of disease or infirmity. Therefore, health status of any individual or community indicates physical capabilities and at the same time social and personal status. In this part, health has been measured objectively in terms of Body Mass Index (BMI) values as well as through

participants' reported morbidity. I have attempted to collect this data from each of the adult member of allotted households. But few adult members responded and others were absent due to pre-occupation during the survey. In aggregate, I collected these data from a total of 80 individuals including 34 females and 46 males.

Table: Health Status (BMI categories) of the study participants

BMI(kg/m ²) categories	Female		Male		Total	
	n	%	n	%	n	%
Under weight(<18.50)	6	17.65	4	8.70	10	12.5
Normal weight(18.50-24.99)	21	61.76	27	58.70	48	60
Over weight (25.00-29.99)	5	14.70	14	30.43	19	23.75
Obese(≥ 30.00)	2	5.88	1	2.17	3	3.75
Total	34	100.00	46	100.00	80	100

Table shows the health status in terms of body mass index (BMI) categories of the study participants. Majority of the female have 'normal' BMI values (61.76%), followed by 'underweight' (17.65%), 'obese' (5.88%) and 'overweight' (14.70%) category. Whereas, majority of males show 'normal weight' category (58.70%), followed by 'overweight' (30.43%), 'underweight' (8.70%) and 'obese' (2.17%) category.

Perceived Environmental Pollution:

Environmental pollution is a significant issue in Haldia Industrial belt. Perceived levels of environmental pollution are important predications for health of the study participants. This study examines perceived environmental pollution and health in Banbishnupur village. The results of this study suggest that in this study area, participants identified two major pollution related problems i.e. Water pollution and Air pollution. Majority of the participants believe that water pollution (41.03%) is the most severe in the locality, while some other participants believe that air pollution (15.38%) is the most severe. Although, several studies reported air pollution is more severe in Haldia than any other parts of the state, West Bengal. This is not

necessarily the reflective response of the study participants. Therefore, the participants come out with several opinions to overcome from the pollution related problems, which includes:

- i) The study participants suggested not to through the garbage or waste materials of households in the pond.
- ii) The pond water should not be used as the sources of bathing water for the domestic animals.
- iii) Pond water may be purified by Lime or Potassium permanganate (KMnO_4) I 2-3 years intervals.

However, they have no suggestion to overcome form air pollution related problems. As this area is an industrial belt, several gasses come out from petrochemical companies and other air pollutant reagents always pollute the air.

Summary and Discussion:

The present cross-section study has been conducted among Scheduled and General Caste population of Banbishnupur. Banbishnupur village situated in the Word No-17, under Haldia Municipality, Purba Medinipur District of West Bengal. The Haldia industrial belt is a major concern to the scientist dealing with the environmental issues. I have conducted my survey on health and pollution among 39 households distributed in 3 hamlets of the village Banbishnupur. The objectives of the present study are to explore the health status and perceived environmental pollution of the study participants.

Health status

Health is an essential component for human survival. Several factor affect health of individuals/population and socio-demographic and physical environment have great influence over the health of population. In the present context, health has been measured objectively in terms of BMI values as well as through participants' reported morbidity. Majority of the study participants belong to normal BMI values. Prevalence of overweight/obesity is more than the underweight prevalence among the study groups. It may be mentioned that male show higher prevalence of overweight/obesity than the females. The morbidity profile of the study participants includes coughed and cold, fever, diabetes, gastritis, heart problem, eye problem, mental disorder, thyroid, etc.

Perceived environmental pollution

Perceived levels of environmental pollution are important predictors for health of the study participants. Environmental pollution is a significant issue in Haldia Industrial belt. Present study participants identified two major pollution related problems i.e. water pollution air pollution in the locality. Majority of the participant believe that water pollution is the most severe in the locality, while some other participants believe that air pollution is the most severe. Although several studies reported air pollution is more severe in Haldia, but it is not reflected in the response of the study participants. Study participants also give some suggestion to overcome from the water pollution related problems, especially for health ecology of the pond. Therefore, environmental pollution related issues needs to be addressed by Government and other organizations that tackle pollution issues, perhaps through educating citizens about pollution and ways to minimize the exposure.

References

1. Holzman, D.C. (2014). Fighting noise pollution: a public health strategy. *Environmental Health Perspectives*, 122(2): A58.
2. Grabow, W.O. (1996). Waterborne diseases: update on water quality assessment and control. *Water SA*, 122(2):193-202.
3. Mukherjee, D., Mukherjee, D., & Bharati, P. (2009). *Laboratory Manual for Biological Anthropology*. New Delhi: Asian Books private Limited.
4. Vadrevu, K. P., Ohara, T., Justice, C. (2014). Air pollution in Asia *Environmental pollution*, 195:233-235
5. WHO Expert Committee. (1995). *Physical Status: The Use and Interpretation of Anthropometry*. WHO Technical Report Series 854. World Health Organization, Geneva.

Chapter: 7**A Study to Evaluate the Morphometric measures of Gonial angle and Bi-gonial width for Healthy Individuals in Garden City university dental camp.****Sandhya Nagolu^{1*}, Dr S Jeyakumar², Anugula Divya Sai³ and Vrinda TA⁴**¹Assistant Professor, School of Health Sciences, Garden City University, Bangalore²Professor, School of Health Sciences, Garden City University, Bangalore³Student, School of Health Sciences, Garden City University, Bangalore⁴Student, School of Health Sciences, Garden City University, Bangalore***E-mail: sandhyanagolu@gmail.com****Abstract**

Objective: The present study conducted in Garden City University aimed to investigate the correlation between two mandibular parameters, namely the gonial angle and bi-gonial width, with age and gender in dentate subjects visiting a dental camp.

Materials and methods: The study has been carried out on a Dental camp organized by Garden City University, Bangalore. The study population consists of 152 healthy subjects, out of 74 males and 78 females aged between 18-30 years. All the subjects having normal facial features and not having any history of joint surgery, facial trauma, temporo-mandibular disorders or any syndromes affecting face or jaw were included in this study. A mathematical protractor is used to measure the gonial angle (measured by an illustrative tangent line that runs along the inferior border of the mandible and the posterior border of the ramus. The intersection of these two lines formed the gonial angle, which was measured either on right or left side) and inch tape is used to measure the bi-gonial width (distance between the two Gonion is the bi-gonial width. The gonion is the exterior angle of the mandible's most inferior, posterior, and lateral point).

Results: The present data shows the range of measurements of gonial angle for male participants was between 110 and 155 mm. The average of gonial angle measurement (mean) for males was 137.55 mm, with a standard deviation of 11.268 mm. For female participants, the range of measurements of gonial angle was between 110 and 142 mm. The average gonial angle measurement (mean) for females was 127.02 mm, with a standard deviation of 9.503 mm. Similarly, the bi-gonial width, which represents the distance between the two angles of the mandible, exhibits a mean value of 6.95 inches in males and 6.05 inches in females. The range of bi-gonial width measurements for males was between 5.6-8.6 inches and females were

between 4.5-7.9 inches. These findings suggest that there are average differences in the gonial angle and bi-gonial width between males and females.

Conclusion: One of the most significant and frequently utilised radiographic markers in orthodontic tracing is the gonial angle and bi- gonial breadth, which is used to assess the growth pattern and plan the course of treatment. The current study's findings reveal that 1-Gonial angle degree grew bigger in males and on the left side as people aged. 2- Males' bi- gonial width was wider and grew wider with age. Consequently, when people aged, their mandibles grew larger as a whole.

Keywords: Bi- gonial width, Gonial angle, Mandible, Morphometry, Sexual dimorphism.

Introduction:

The mandible, commonly known as the jawbone, is indeed the largest and strongest bone of the skull. It plays a crucial role in various functions such as chewing, speaking, and providing structural support to the face. Fehrenbach and Herring (2012). Certain anatomical landmarks of the mandible, such as the gonial angle, ante gonial angle, mental foramen, mandibular foramen, and mandibular canal can undergo changes during life based on factors such as age, gender, and dental status. Regarding the patterns and rates of developing growth, it has been observed that the mandibular condyle and ramus exhibit a high degree of sexual dimorphism. Kambylatkas et al. (2006). The gonial angle is an important radio-morphometric index that refers to the angle formed by the intersection of two lines: one drawn along the lower border of the mandible (lower jawbone) and another drawn along the posterior border of the ramus of the mandible (the vertical portion of the jawbone). It is also known as the mandibular angle or the angle of the mandible. Ghosh et al. (2009). A person's mandible plays a significant part in determining the individual's facial features. The teeth and age condition throughout life have an impact on the morphological changes in the mandible. Evaluation of the effects of age and sex on the mandibular gonial angle is particularly relevant given the significance of maintaining facial aesthetics. Huumonen et al. (2010). The average gonial angle in adults is around 120 to 135 degrees, but it can range from 90 to 170 degrees. In general, a more obtuse (larger) gonial angle is associated with a more square-shaped lower face, while a more acute (smaller) angle is associated with a more pointed or V-shaped lower face. It's important to note that the gonial angle alone cannot determine the overall shape and proportions of the face. It is just one of many factors that contribute to the overall facial aesthetics and harmony. Additionally, the gonial angle can change throughout a person's life due to growth, aging, and

the effects of dental and orthodontic treatment. Chole et al. (2013). Clinically, the measurement of the gonial angle can be useful in orthodontics, oral and maxillofacial surgery, and forensic anthropology. In orthodontics, it helps in diagnosing and planning the treatment of malocclusions (improper alignment of the teeth and jaws). In oral and maxillofacial surgery, it assists in assessing facial asymmetry and planning corrective procedures. Forensic anthropologists also use the gonial angle as one of the parameters for identifying human remains. Saini (2013).

In the field of medicolegal practice, the identification of human remains is indeed crucial, and various methods are employed to achieve this. One such method involves evaluating the mandible (lower jawbone) and its characteristics. Indira et al. (2012). Apart from determining age and gender, measurements and landmarks on the mandible can be used for identification purposes. The gonial angle, specifically, has been found to be a useful tool in estimating age, especially in urgent situations like mass tragedies, excavated remains, violent dismemberment cases, or missing persons investigations. Williams et al. (2000) Accurate measurement and assessment of gonial angle values are essential in order to derive age and gender information from human remains. In this context, a mathematical protractor has been utilized to assess the anatomic gonial angle values. This approach aims to replicate the outcomes obtained through lateral radiography, which is a common method for measuring the gonial angle. By comparing the measured angle values with established age and gender standards, forensic experts can make determinations about the individual's identity and other pertinent information. Larheim and Svanaes (1986). The study conducted in Garden City University aimed to investigate the correlation between two mandibular parameters, namely the gonial angle and bi-gonial width, with age and gender in dentate subjects visiting a dental camp. The researchers were interested in exploring potential applications of this data in forensic cadaver identification and monitoring growth patterns of individuals in orthodontic assessments. The findings of this study could contribute to the field of forensic science by providing additional tools for cadaver identification. Furthermore, orthodontists and dental professionals may benefit from the knowledge gained regarding growth patterns in the mandible, facilitating more accurate treatment planning and assessments.

Aims & Objectives:-

- To assess the relation in measurements of gonial angle and age or gender among healthy adult individuals.
- To assess the association between bi-gonial width and age or gender.

- To assess the usefulness of the gonial angle and bi-gonial width of the mandible as forensic tools for age and gender prediction.

Materials and Methods: The study has been carried out on a Dental camp organized by Garden City University, Bangalore. The study population consists of 152 healthy subjects, out of 74 males and 78 females aged between 18-30 years. All the subjects having normal facial features and not having any history of joint surgery, facial trauma, temporo-mandibular disorders or any syndromes affecting face or jaw were included in this study. All study participants signed a general consent form, indicating their consent to the possibility of their data being used in clinical research initiatives.

Procedure: A mathematical protractor is used to measure the gonial angle and inch tape is used to measure the bi-gonial width...

Gonial angle: The gonial angle (also known as the mandibular angle) is measured by an illustrative tangent line that runs along the inferior border of the mandible and the posterior border of the ramus. The intersection of these two lines formed the gonial angle, which was measured either on right or left side. Lux et al. (2003).

Bi-gonial width: The distance between the two Gonion is the bi-gonial width (Go). The gonion is the exterior angle of the mandible's most inferior, posterior, and lateral point. Al-Shamout et al. (2012)

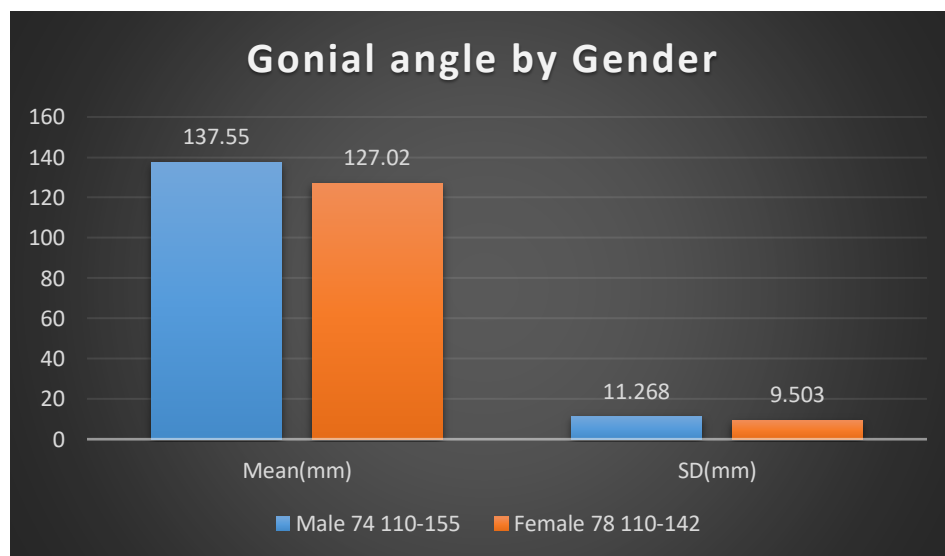
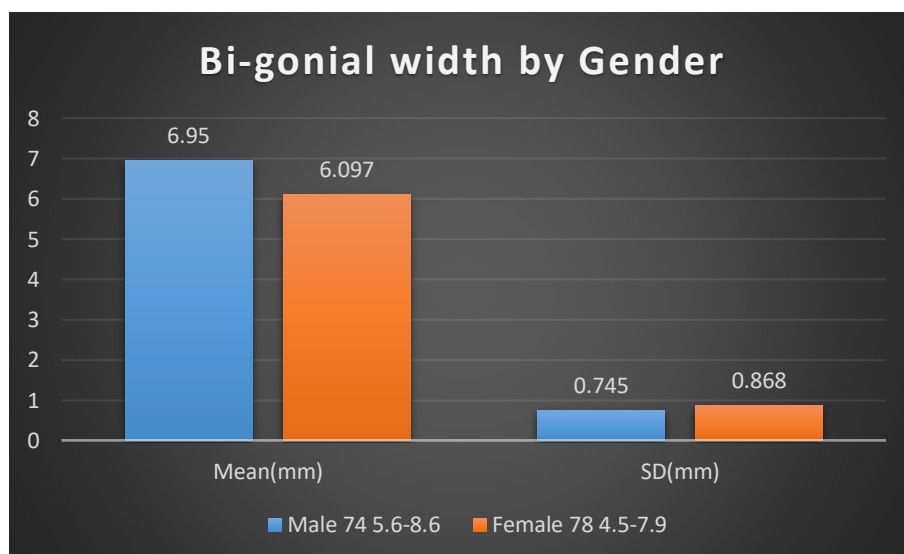
Results: The present data shows the range of measurements of gonial angle for male participants was between 110 and 155 mm. The average of gonial angle measurement (mean) for males was 137.55 mm, with a standard deviation of 11.268 mm. For female participants, the range of measurements of gonial angle was between 110 and 142 mm. The average gonial angle measurement (mean) for females was 127.02 mm, with a standard deviation of 9.503 mm. (Table 1 & Graph 1) Similarly, the bi-gonial width, which represents the distance between the two angles of the mandible, exhibits a mean value of 6.95 inches in males and 6.05 inches in females. The range of bi-gonial width measurements for males was between 5.6-8.6 inches and females was between 4.5-7.9 inches (Table 2 & Graph 2) These findings suggest that there are average differences in the gonial angle and bi-gonial width between males and females. These measurements could serve as important indicators when attempting to identify unidentified skeletons.

Table 1 Showing Gonial angle in age group 18-30 years

Sex	No of Subjects	Range (degree)	Mean(degree)	SD(degree)
Male	74	110-155	137.55	11.268
Female	78	110-142	127.02	9.503

Table 2 Showing Bi-gonial width of lower jaw in age group 18-30 years

Sex	No of Subjects	Range (inch)	Mean(inch)	SD(inch)
Male	74	5.6-8.6	6.95	0.745
Female	78	4.5-7.9	6.097	0.868

Graph 1: Gonial angle by Gender in age group 18-30 years**Graph 2: Bi- Gonial width by Gender in age group 18-30 years**

Discussion:

By examining the pelvis, skull, and mandible, forensic anthropologists and osteologists can gather valuable clues about the biological sex of an individual, which can be crucial in forensic investigations or archaeological studies. However, it's important to note that sex determination based solely on skeletal remains is not always completely accurate, and additional methods and criteria, such as DNA analysis or a combination of different skeletal traits, may be employed to enhance the accuracy of sex estimation. Kumar and Lokanadham (2013).

Sample Sizes of this study states that the male population consists of 74 subjects, while the female population has 78 subjects aged between 18-30years. Studies on the morphology and morphometry of different populations and genders have revealed that the size and form of the gonial angle vary. Based on the current findings, mean values of gonial angle higher in males (137°) compared to females (127°) where as the mean bi-gonial width for males is 6.95 inches, while for females, it is 6.09 inches. This indicates that there might be sexual dimorphism in the angle measurement, with males tending to have larger angles compared to females. These measurements suggest that there might be differences in mandibular size and shape between males and females. By utilizing these measurements and their respective mean values, researchers and forensic experts can potentially use the gonial angle and bi-gonial width as useful criteria in identifying unknown skeletal remains, particularly in differentiating between male and female individuals. The current findings in the study indicate that the gonial angle tends to increase in size as individuals age, with older age groups exhibiting larger and more flared angles compared to younger age groups. These results are consistent with previous studies that also observed similar age-related changes in the gonial angle. (Ghosh et al. (2009), Al-Shamout et al. (2012), Leversha et al. (2016)). However, there is a disagreement with the findings of Upadhyay et al., as their study reported a decrease in the gonial angle with advancing age. Upadhyay et al. (2012). The contrasting results could be attributed to several factors such as differences in sample size, age range, racial composition of the samples, variations in measurement methods, and the type of radiographs used. In terms of gender differences, many authors have reported that females tend to have larger (wider) gonial angles than males across all age groups. (Ghosh et al. (2009), Chole et al. (2013), Leversha et al. (2016), Joo et al. (2013), Taleb and Beshlawy (2015)). These findings contradict the results of the present study. On the other hand, some studies have found no correlation between the gonial angle and gender or have even suggested that males may have wider gonial angles. (Al-Shamout et al. (2012), Upadhyay et al. (2012), Dutra et al. (2004)). These discrepancies could be attributed to variations in sample size, sample ratios (male-to-female ratio), and racial

diversity among the study populations. Additionally, when comparing the gonial angles of the right and left sides, the results of the present study indicate a greater angle in the left side for both genders and across all age groups. This finding aligns with the study conducted by Leversha et al. (2016). However, other studies have reported that the right side exhibits a greater gonial angle. (Kumar and Lokanadham (2013), Upadhyay et al. (2012)). These differences in findings may be attributed to variations in sample size, racial composition, and the specific method employed to measure the gonial angle. The findings revealed that bi-gonial width increased with age, which is consistent with the studies conducted by Al shamout et al. and Huumoneen et al. (Al-Shamout et al. (2012), huumonen et al. (2010)). However, these results disagreed with the findings of Laversha et al., who observed a steady decrease in bi-gonial width with increasing age. Leversha et al. (2016). The disparity in findings could be attributed to differences in sample size, age range, group distribution, and ethnicity among the study populations. Furthermore, the present study found that, on average, males had a higher bi-gonial width than females, which aligns with the findings of both Al shamout et al. and Laversha et al. (Al-Shamout et al. (2012), Leversha et al. (2016)).

It's important to note that the accuracy and applicability of these indicators may vary based on the specific population studied, the sample size, and other factors. Additionally, further research and validation studies are typically required to establish the reliability and validity of these measurements for forensic identification purpose.

Conclusion

One of the most significant and frequently utilised radiographic markers in orthodontic tracing is the gonial angle and bi- gonial breadth, which is used to assess the growth pattern and plan the course of treatment. Evaluations of these sites are crucial for forensic dentistry as a foundational reference as well as for comparison with other countries and races.

1-Gonial angle degree grew bigger in males and on the left side as people aged.

2- Males' bi- gonial width was wider and grew wider with age. Consequently, when people aged, their mandibles grew larger as a whole.

Conflict of Interest: None

Acknowledgements: None

References

Al-Shamout, R., Ammoush, M., Alrbata, R. and Al-Hababab, A., 2012. Age and gender differences in gonial angle, ramus height and bigonial width in dentate subjects. *Pakistan Oral & Dental Journal*, 32(1).

Chole, R.H., Patil, R.N., Balsaraf Chole, S., Gondivkar, S., Gadbail, A.R. and Yuwanati, M.B., 2013. Association of mandible anatomy with age, gender, and dental status: a radiographic study. *International Scholarly Research Notices*, 2013.

Dutra, V., Yang, J., Devlin, H. and Susin, C., 2004. Mandibular bone remodelling in adults: evaluation of panoramic radiographs. *Dentomaxillofacial Radiology*, 33(5), pp.323-328.

Fehrenbach MJ, Herring SW .Illustrated anatomy of the head and neck.4th ed. Elsevier; 2012; Chap 3, 44-55.

Ghosh, S., Vengal, M. and Pai, K.M., 2009. Remodeling of the human mandible in the gonial angle region: a panoramic, radiographic, cross-sectional study. *Oral Radiology*, 25, pp.2-5.

Huumonen, S., Sipilä, K., Haikola, B., Tapio, M., Söderholm, A.L., Remes-Lyly, T., Oikarinen, K. and Raustia, A.M., 2010. Influence of edentulousness on gonial angle, ramus and condylar height. *Journal of oral rehabilitation*, 37(1), pp.34-38.

Indira, A.P., Markande, A. and David, M.P., 2012. Mandibular ramus: An indicator for sex determination-A digital radiographic study. *Journal of forensic dental sciences*, 4(2), p.58.

Joo, J.K., Lim, Y.J., Kwon, H.B. and Ahn, S.J., 2013. Panoramic radiographic evaluation of the mandibular morphological changes in elderly dentate and edentulous subjects. *Acta Odontologica Scandinavica*, 71(2), pp.357-362.

Kambylafkas, P., Murdock, E., Gilda, E., Tallents, R.H. and Kyrkanides, S., 2006. Validity of panoramic radiographs for measuring mandibular asymmetry. *The Angle Orthodontist*, 76(3), pp.388-393.

Kumar, M.P. and Lokanadham, S., 2013. Sex determination & morphometric parameters of human mandible. *Int J Res Med Sci*, 1(2), pp.93-96.

Larheim, T.A. and Svanaes, D.B., 1986. Reproducibility of rotational panoramic radiography: mandibular linear dimensions and angles. *American Journal of Orthodontics and Dentofacial Orthopedics*, 90(1), pp.45-51.

Leversha, J., McKeough, G., Myrteza, A., Skjellrup-Wakefiled, H., Welsh, J. and Sholapurkar, A., 2016. Age and gender correlation of gonial angle, ramus height and bigonial width in dentate subjects in a dental school in Far North Queensland. *Journal of clinical and experimental dentistry*, 8(1), p.e49.

Lux, C.J., Conradt, C., Burden, D. and Komposch, G., 2003. Dental arch widths and mandibular-maxillary base widths in Class II malocclusions between early mixed and permanent dentitions. *The Angle Orthodontist*, 73(6), pp.674-685.

Saini, V., 2013. Metric study of fragmentary mandibles in a North Indian population. *Bulletin of the International Association for Paleodontology*, 7(2), pp.157-162.

Taleb, N.S.A. and Beshlawy, M.E., 2015. Mandibular ramus and gonial angle measurements as predictors of sex and age in an Egyptian population sample: A digital panoramic study. *J Forensic Res*, 6(5), pp.1-7.

Upadhyay, R.B., Upadhyay, J., Agrawal, P. and Rao, N.N., 2012. Analysis of gonial angle in relation to age, gender, and dentition status by radiological and anthropometric methods. *Journal of forensic dental sciences*, 4(1), p.29.

Williams PL, Bannister LG, Berry MM. Gray's Anatomy. 38th Ed, New York, Churchill Livingstone. 2000: 409-19.

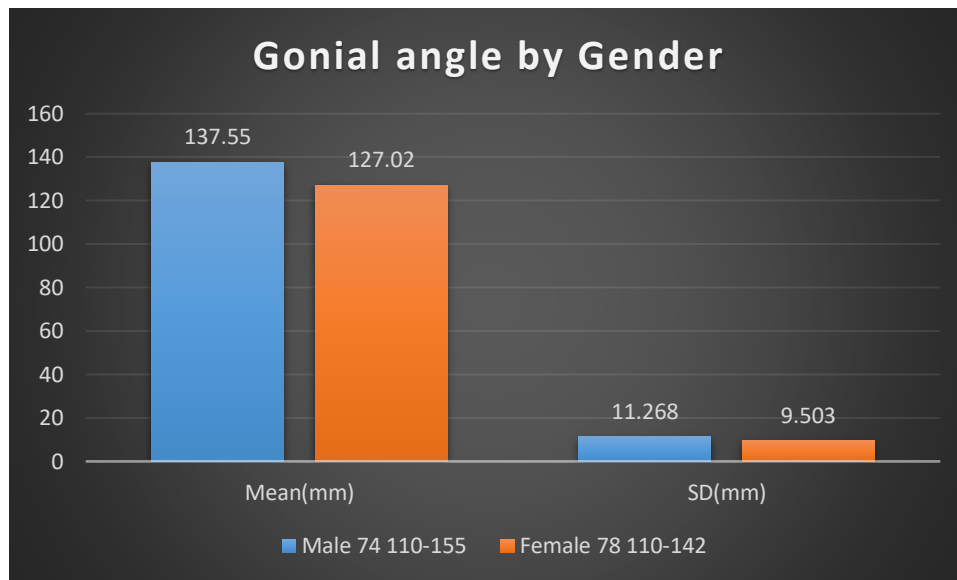
Table 1 Showing Gonial angle in age group 18-30 years

Sex	No of Subjects	Range (degree)	Mean(degree)	SD(degree)
Male	74	110-155	137.55	11.268
Female	78	110-142	127.02	9.503

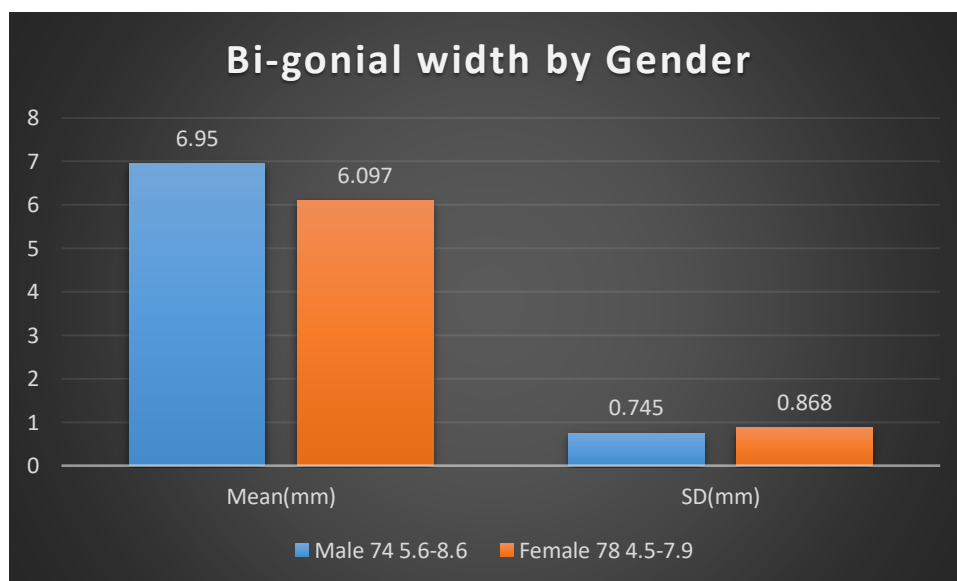
Table 2 Showing Bi-gonial width of lower jaw in age group 18-30 years

Sex	No of Subjects	Range (inch)	Mean(inch)	SD(inch)
Male	74	5.6-8.6	6.95	0.745
Female	78	4.5-7.9	6.097	0.868

Graph 1: Gonial angle by Gender in age group 18-30 years



Graph 2: Bi- Gonial width by Gender in age group 18-30 years



Chapter: 8**Prevalence of Overweight and Obesity (Overnutrition) among the Bengali Adolescent Girls: A Cross-Sectional Study from Darjeeling District, West Bengal (India)****Mampi Debnath****Research Scholar, Department of Anthropology, University of North Bengal****Raja Rammohanpur, West Bengal (734013), India*****E-mail: debmampi093@gmail.com****Abstract**

Background: Obesity is an emerging epidemic in the present era. The prevalence of overnutrition (overweight and obesity) is rising day by day not only among the adults but the adolescents also. It is also found to be associated with various Cardio-vascular diseases, non-communicable and other diseases in the low-middle income countries including India.

Aim: The aim of the present study was to assess the prevalence of overweight and obesity among the school-going Bengali adolescent girls of Darjeeling district.

Material and Methods: Cross-sectional study was carried out among the adolescent girls (10-17 years) studied in two government Bengali medium schools of Matigara block of Darjeeling district. Sample size for the present study was 200. Prevalence of overweight and obesity were calculated according to WHO and ASIA PACIFIC cut offs. Statistical analysis was done using SPSS (v.26).

Results: The mean age, height, weight and BMI for the present studied girls were 13.46 ± 2.24 years, 147.86 ± 7.80 cm, 43.27 ± 11.85 kg and 19.61 ± 4.41 kg/m² respectively. The prevalence of overweight/ obesity among the adolescent girls were found to be 10%/4% and 5%/14% according to WHO and ASIA PACIFIC cut offs.

Conclusion: The present study shows an alarming prevalence of overweight and obesity among the adolescent girls. Proper nutritional awareness can help to reduce such health burden among the adolescent girls.

Keywords: Bengali adolescent girls, Overweight, Obesity, Over-nutrition, Darjeeling

Introduction

Overnutrition (combined form of overweight and obesity), occurs when there is excessive intake of nutrients, leading to accumulation of body fat that impairs health¹. By definition,

Overweight is having excess body weight as per specific height and *Obesity* is an unusual growth of adipose tissue due to an increase of size of fat cell or number of fat cells or both². The primary cause for overweight and obesity is the energy imbalance between consumed and expended calories and overnutrition (overweight and obesity) are linked to more death than underweight³. Multifactorial causes such as biological, genetic, social and environmental causes are also associated with overnutrition⁴. Many co-morbid conditions such as psychological, neurological, hepatic, pulmonary, renal and orthopedic disorders are associated with childhood obesity along with cardio-vascular problems, hypertension etc.⁵

According to WHO⁶, obesity prevalence is seen to be 4.5% in developing countries, 20.4% in the developing countries and it is 17.1% in case transitional countries⁷. Overweight and obesity are also a risk factor (fifth leading factor) for global death³. The global prevalence of obesity significantly increased from 4-5% in the 1980s to 19% in 2016⁸ while, the prevalence of overweight and obesity was 4.9% in 2010 in Asia^(9,3). According to NFHS-4(2015-16), among the 15-19 years age-group female, almost 41.9% girls were thin while the prevalence of overweight was 4.2%¹⁰. According to different studies the factors related to overweight and obesity among the adolescents are family history of obesity, fast food consumption, milk consumption, screen time (tv or computer), parent's literacy level, child sleep duration etc. (7,11,12,13,14).

There is a scarcity in literature about the study of overnutrition among the adolescents of North Bengal area of west Bengal. The present study aims to assess the prevalence of overweight and obesity among the adolescent girls Matigara block of Darjeeling district.

Materials and Methods

Study Area and Study Participants: The present cross-sectional study was conducted among the adolescent girls residing in the area of Matigara Block of Siliguri sub-division, Darjeeling District. Mainly the school-going adolescent girls (10-17 years) were included in this study belongs to the Bengali Hindu Caste Population (BHCP)¹⁵. Consent was taken from the Headmistress as well as the participants and one of their parents. Selection of the participants was random. A total of 209 individuals was approached for the study and finally 200 individuals were included (9 individuals were excluded because either they were ill or have physical deformities).

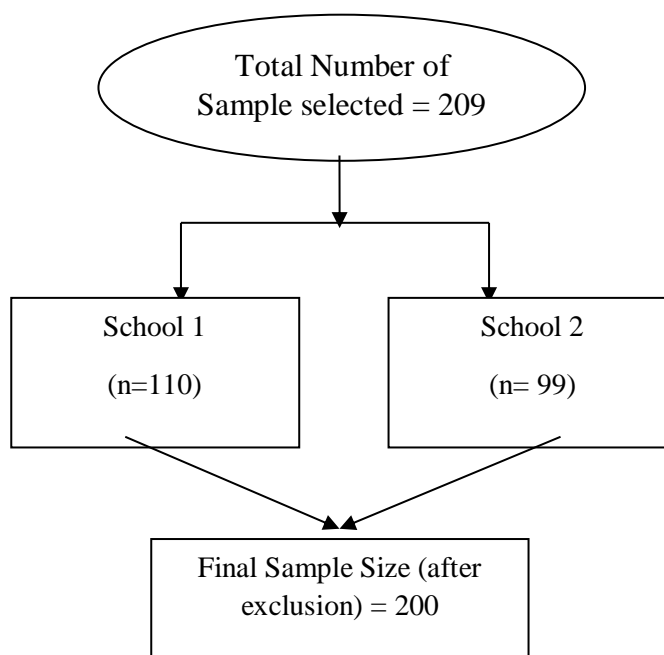


Figure 1: Flowchart depicting the distribution of study participants

Anthropometric Measurements taken: Height and weight were taken using an anthropometer rod and a portable weighing machine. Height and were measured to the nearest 0.1 cm (bare footed) 0.5 kg respectively. The study was conducted according to the ethical guidelines of the Helsinki declaration of 2000¹⁶. For assessing the BMI, WHO¹⁷ and Asia-Pacific¹⁸ cut off were considered.

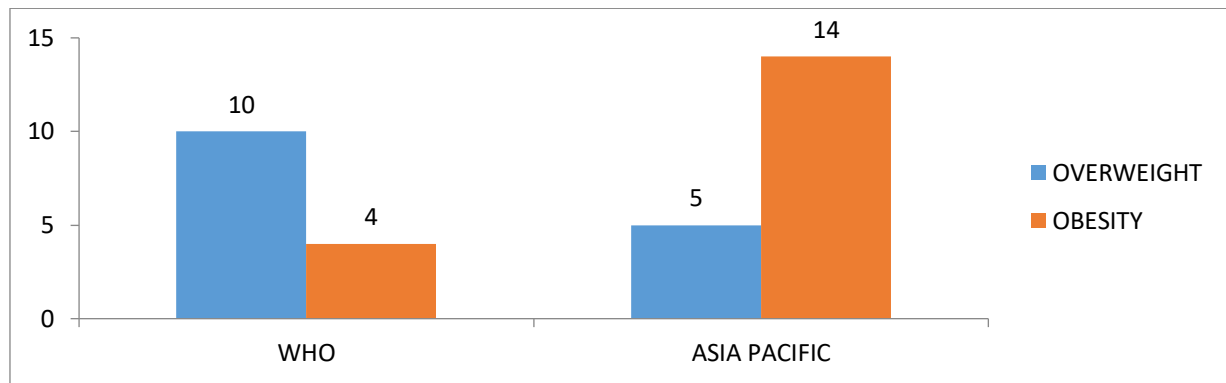
Statistical Analysis: SPSS (v.26) was used for statistical analysis. Descriptive statistics were calculated. $P < 0.01$ and < 0.05 considered statistically significant.

Results

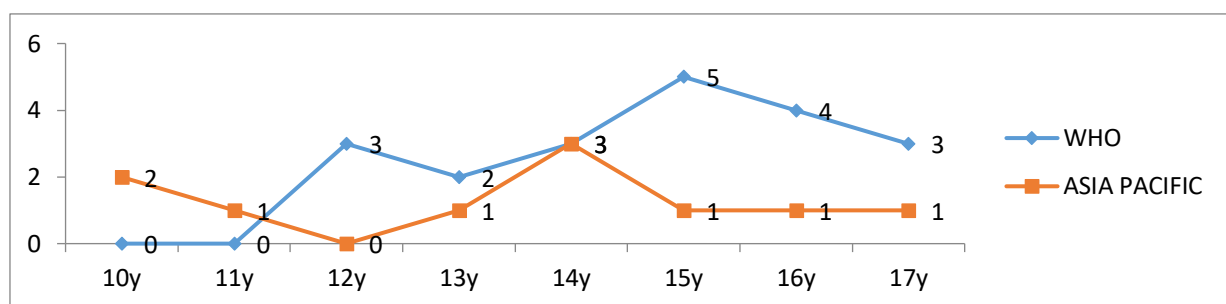
The descriptive statistics for mean age, height, weight and BMI of the present studied girls presented in Table 1. From ANOVA, it is found that age-specific mean differences were statistically significant in height (F-value: 17.22, d.f: 7, 199), weight (F-value: 9.60, d.f: 7, 199) and BMI (F-value: 4.56, d.f: 7, 199) ($p < 0.01$). Graph 1 represents the prevalence percentage of overweight and obesity among the studied girls as per the WHO and Asia pacific cut offs. Graph 2 and 3 showing the distribution of overweight and obesity (in numbers) of the studied girls according to the age-groups. No girls belong to age groups of 10, 11 and 12 years were overweight according to WHO cut off. Obesity was totally absent in 10 and 11 years age-groups.

Table 1: Age-wise descriptive statistics of mean and standard deviation (SD) of age, height, weight and BMI of the studied girls.

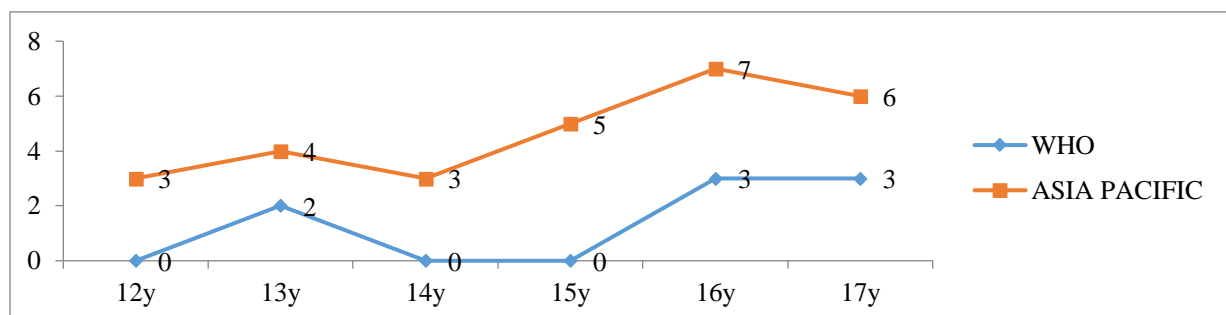
AGE			HEIGHT		WEIGHT		BMI	
Early adolescent girls (10-13 yrs)		103						
Late adolescent girls (14-17 yrs)		97						
Number of girls	Mean	SD	Mean	SD	Mean	SD	Mean	SD
10 yr (25)	10.06	0.035	137.76	7.159	33.73	7.073	17.64	2.812
11 yr (26)	11.05	0.038	142.68	6.281	35.11	5.688	17.24	2.586
12 yr (26)	12.06	0.030	147.80	5.722	40.66	8.826	18.55	3.604
13 yr (26)	13.07	0.023	149.02	6.440	43.63	15.151	19.47	6.986
14 yr (26)	14.06	0.033	150.73	6.954	45.49	9.614	19.95	3.551
15 yr (25)	15.04	0.027	152.82	4.489	48.66	8.319	20.82	3.349
16 yr (26)	16.05	0.036	151.66	6.104	49.53	12.618	21.52	5.181
17 yr (20)	17.05	0.036	150.99	6.307	50.99	12.670	22.32	5.099
Total (200)	13.46	2.24	147.86	7.80	43.27	11.85	19.61	4.41



Graph 1: Graph comparing the prevalence (%) of overweight and obesity among the studied girls according to the WHO¹⁷ and Asia pacific¹⁸ classifications.



Graph 2: Graph showing the distribution of overweight girls (in numbers) according to the age-groups.



Graph 3: Graph showing the distribution of obese girls (in numbers) according to the age-groups.

Discussion

The prevalence of overnutrition is 14% (WHO) and 19% (Asia Pacific) for the present study respectively. Many studies revealed the scenario related to overnutrition among the adolescent girls of different South-Asian countries such as 32.9% overall prevalence (overweight and obesity) among the Bangladeshi girls¹⁹, 9.1% among the Nepali girls³ and only 1% among the female adolescents of Bhutan²⁰. The prevalence of overweight and obesity among the

adolescent girls of Pakistan and Sri Lanka and Iranian adolescent girls were 11.4%/4.4%⁸, 9.4%/5.5%²¹ and 24.1% and 6.5%²² respectively. Table 2 represents a comparison of the prevalence of overweight and obesity among the Indian adolescent girls and different regions of West Bengal with the present study. Different studies reported prevalence of overweight and obesity among Indian adolescent girls ranged from 5.9 to 44.9% and 2.7-32% respectively^(7,23,24,2,14,25,11,26,13,27,28,29,10).

Table 2: Comparison of the study findings regarding the prevalence of Overweight and obesity (%) of the present study and other Indian studies.

Sl no.	Indian Territories	Author (year)	Sample size	Age-groups (years)	Prevalence (%)	
					Overweig ht	Obesity
1	Andhra Pradesh	Anuradha et al. (2015) ⁷	1161	12-16	10.3	4.8
2	Bihar	Lata (2023) ²³	210	13-18	18.1	9.5
3	Gujarat	Kumar et al. (2012) ²⁴	801	13-15	13.5	6.6
4	Haryana	Goyal et al. (2020) ²	694	10-19	20.32	6.77
5	Kerala	Paul and Usha (2020) ¹⁴	772	12-18	15.54	4.92
6	KarNataka	Thomas et al. (2021) ²⁵	200	11-15	11.5	4.0
7	Madhya Pradesh	Gupta et al. (2023) ¹¹	347	13-17	12.17	3.7
8	Maharashtra	Bhattad et al. (2023) ²⁶	250	12-16	44.9	32
9	Odisha	Panda (2017) ¹³	290	10-15	10.3	3.8
10	Punjab	Mohan et al. (2019) ²⁷	969	11-17	10.5	4.1
11	Tamil Nadu	Priya and Sabitha (2020) ²⁸	5665	13-15	11.0	4.0
12	Uttarakhand	Belwal et al. (2020) ²⁹	776	6-15	8.0	3.5

13	Uttar Pradesh	Ahmad et al. (2018) ¹⁰	2400	10-19	5.9	2.7
14	West Bengal (Some districts)					
	Kolkata	Roy et al. (2022) ³⁰	1041	10-17	18.9	23.7
	North 24 Parganas	Das (2017) ⁵	202	12-14	-	15.84
	Purba Burdhaman	Naskar and Roy (2020) ¹²	357	13-18	4.5	2.5
	Present Study (Darjeeling)	Debnath M	200	10-17	10.0 (WHO) 4.0 (Asia Pacific)	5.0 (WHO) 14.0 (Asia Pacific)

Conclusion

Overall prevalence of overweight and obesity was 14% according to WHO cut off and the prevalence was slightly higher in case of Asia Pacific cut off (19%) among the studied Bengali girls. Spreading of awareness and nutritional education among the adolescent girls as well as their family members is essential to reduce the burden of overnutrition and for their better well-being.

Limitations of the Present Study

Present study showed the prevalence of overnutrition among the Bengali adolescent girls of the age –groups of 10-17 years of Darjeeling district. But there are some limitations such as: 1. Small sample size

2. Cross-sectional nature of the study

3. Also, the present study does not contain any information related to their socio-demographic or socio-economic status.

Acknowledgement: The author acknowledged the help and co-operation of the participants, Heads of the Institutions and the Department of Anthropology, University of North Bengal.

Conflict of Interests: There was no conflict of interest.

References

1. Mathur N and Pillai R. Overnutrition: Current Scenario and combat strategies. *The Indian Journal of Medical Research*. 2019; 149(6):695-705.
2. Goyal A, Gadi NA, Kumar R. Prevalence of overweight and obesity among rural and urban school going adolescents (10-19 years) in North India: A population based study. *International Journal of Medical Science and Education*. 2020; 7(2): 66-75.
3. Acharya B, Chauhan HS, Thapa SB, Khaple HP, Malla D. Prevalence and socio-demographic factors associated with overweight and obesity among adolescents in Kaski, Nepal. *Indian journal of community Health*. 2014; 26(supple S2):118-122.
4. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: Public health crisis, common sense cure. *Lancet*. 2002; 360:473-82.
5. Das T. Prevalence of obesity among adolescent Bengali girls age ranged between 12 and 14 year. *Indian Journal of Biological Sciences*. 2017; 23:87-97.
6. World Health Organization. Geneva: WHO Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. 2004; WHO Technical Report Series no. 894.
7. Anuradha RK, Sathyarathi RB, Reddy TM, Hemalatha R, Sudhakar G, Geetha P et al. Effect of social and environmental determinants on overweight and obesity prevalence among adolescent school children. *Indian Journal of Endocrinology and Metabolism*. 2015; 19(2):283-287.
8. Ali PZ, Sayed TM, Oureshi MA, Tahir H, Sheikh GM, Imran M. Epidemiological study on overweight and obesity among adolescent boys and girls. *Pakistan Journal of Medical and Health Sciences*. 2021; 15(11):3430-3433.
9. Balarajan Y, Villamor E. Nationally representative surveys show recent increases in the prevalence of overweight and obesity among women of reproductive age in Bangladesh, Nepal, and India. *Journal of Nutrition*. 2009; 139:2139-2144.
10. Ahmad S, Shukla NK, Singh JV, Shukla R, Shukla M. Double burden of malnutrition among school-going adolescent girls in North India: A cross-sectional study. *Journal of Family Medicine and Primary Care*. 2018;7(6): 1417-1424.
11. Gupta M, Patidar AK, Sharma V, Toppo M. The lifestyle pattern and prevalence of obesity and overweight among the adolescent of Bhopal city, Madhya Pradesh, Central India. *Global Journal of Public Health Medicine*. 2023; 5(1): 762-771.
12. Naskar P, Roy S. Obesity and related lifestyle behavior of adolescent school students in a rural area of West Bengal, India. *IOSK Journal of Dental and Medical Sciences*. 2020; 19(2) Ser.6 44-49.
13. Panda SC. Overweight and obesity and lifestyle of urban adolescent school children of eastern state of India. *Journal of Research in Medical Sciences*. 2017; 5(11): 4770-4775.
14. Paul C, Usha VK. Prevalence and Predictors of overweight and obesity among adolescents. *RCUHS Journal of Nursing Sciences*. 2020;10(2):69-73.

15. Das Choudhury AB, Basu S. Chakraborty S. Twinning rate in the Muslim population of West Bengal. *Acta Geneticae Medicae et Gemellologiae: twin research*. 1993; 42(1):35- 39.
16. Touitou Y, Portaluppi F, Smolensky MH, Rensing L. Ethical principles and standards for the conduct of human and animal biological rhythm research. *Chronobiol Int* 2004; 21:161-70.
17. World Health Organization Physical Status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee. 1995. WHO Technical Report Series no. 854. Geneva: WHO.
18. Lim JU, Lee JH, KIM JS, Hwang YII, Kim TH, Lim SY et al. Comparison of World health Organization and Asia-Pacific body mass index classifications in COPD patients. *International Journal of Chronic Obstructive Pulmonary Disease*. 2017; 12: 2465-2475.
19. Hussain MT, Luies SK, Biswas T. Prevalence and Factors Associated with Overweight and Obesity among Primary school children (9-14 years) in a selected Area of Dhaka, Bangladesh: A Cross-sectional Study. *Indian Journal of Community Medicine: official Publication of Indian Association of Preventive and Social Medicine*. 2020; 45(4):429-434.
20. Norbu W, Waangdi U, Dorji D, Arthan D, Soonthornworasiri N, Maneekan P et al. Obesity prevalence and contributing factors among adolescents in secondary schools in Pemagatshil district, Bhutan: *International Journal of adolescent medicine and health*. 2017; 31(1), p20160143.
21. Karuppiyah D, Markandu M. Prevalence of Obesity, Overweight and Central obesity among adolescent girls in national school in Batticaloa district, Sri Lanka. *Sri Lanka Journal of Diabetes, Endocrinology and Metabolism*. 2018; 8(1):17-22.
22. Abiri B, Sarbakhsh P, Vafa M. Prevalence of overweight, obesity and associated risk factors in healthy female adolescents in Tehran, Iran. *Central Asian Journal of global health*. 2019; 8(1):413.
23. Lata K. Understanding the relationship between diet, physical activity, and weight status in urban adolescent girls. *International Journal of Academic Medicine and Pharmacy*. 2023; 5(4):843-846.
24. Kumar N, Goyal J, Parmar I, Shah V. Prevalence of overweight and obesity in affluent adolescent girls in Surat City, Western India. *International Journal of Medical Science and Public Health*. 2012; 1(1).
25. Thomas UM, Narayanappa D, Sujatha MS. Prevalence of overweight and obesity among school children in Mysuru, Karnataka. *Journal of family Medicine and Primary Care*. 2021; 10(8):2788-2792.
26. Bhattad S, Bhattad S, Kendre V, Kudrikar S, Takalkar AA. Prevalence of overweight and obesity in school going Children: A community based cross-sectional study from Latur, Maharashtra. *International Journal of Life Sciences Biotechnology and Pharma Research*. 2023; 12(3):107-111.

27. Mohan B, Verma A, Singh K., Singh K, Sharma S, Bansal R et al. Prevalence of sustained hypertension and obesity among urban and rural adolescents: a school-based cross-sectional study in north India. *BMJ Open*. 2019; 9:e027134.
28. Priya A, Sabitha N. Prevalence of obesity among Adolescent School going children (13-15 years) in Coimbatore. *IOSR Journal of Nursing and Health Science*. 2020; 9(3): 29-35.
29. Belwal E, Devi KU, Kuna A. Prevalence of childhood obesity among school children of Dehradun city, Uttarakhand. *International Journal of Current Microbiology and Applied Sciences*. 2020; 9(11): 3391-3401.
30. Roy P, Chakraborty S, Chatterjee D, Bharati P. Prevalence and factors Associated with overweight/obesity in Adolescent School Girls: A Cross-sectional Study in Kolkata, India. *Anthropological Review*. 2022; 85(2): 147-162.

Chapter: 9**Significance of Artificial Intelligence in Oral and Maxillofacial Surgery****Maryam Akhtar¹ and Eram Anwar^{2*}****Department of Oral & Maxillofacial Surgery,****Buddha Institute of Dental Sciences and Hospital, Patna, Bihar (India)*****E-mail: eramanwar2016@gmail.com**

Abstract: The integration of Artificial Intelligence (AI) into the field of oral and maxillofacial surgery represents a watershed moment in modern healthcare. This abstract provides an overview of the profound significance of AI in this specialized surgical discipline, showcasing how it is poised to revolutionize the entire spectrum of patient care.

Oral and maxillofacial surgery, characterized by its intricate anatomical focus and diverse array of conditions, has traditionally relied on the skill and experience of surgeons. However, the advent of AI has ushered in a new era marked by precision, efficiency, and personalization. AI's ability to process extensive medical images and clinical records datasets has enabled rapid and precise diagnostics, individualized treatment planning, and real-time intraoperative assistance. This has significantly improved surgical outcomes, reduced complications, and elevated the quality of care. Beyond surgery, AI extends its impact to pre-operative consultations and post-operative care. It empowers clinicians to deliver highly personalized treatment strategies, while AI-driven monitoring systems enhance patient safety and expedite recoveries. Moreover, AI fosters global collaboration among oral and maxillofacial surgeons, enabling the exchange of expertise and insights across borders. Telemedicine, supported by AI, facilitates remote consultations and case discussions, benefiting patients worldwide. In a nutshell, this chapter highlights how AI is reshaping the landscape of oral and maxillofacial surgery in myriad ways, transcending the boundaries of traditional practices. As AI continues to evolve and integrate further into this field, patients can anticipate superior, personalized care, while surgeons are empowered with unparalleled tools to advance their discipline and achieve surgical excellence.

Keywords: Artificial intelligence, Oral and maxillofacial surgery, AI-driven robotic systems, Orthognathic Surgery, Dental Implant.

Introduction:

Oral and maxillofacial surgery, at its core, is a discipline that deals with the complex anatomical structures of the face, mouth, and jaws, addressing a wide spectrum of conditions, from

congenital abnormalities and traumatic injuries to oral tumors and facial reconstruction. The advent of AI has sparked both wonder and concern, with some marveling at the possibilities while others fear the idea of machines supplanting humans [1]. Historically, the field has relied heavily on the skill, experience, and intuition of surgeons, but the entrance of AI has ushered in a transformative era that augments the precision, efficiency, and comprehensiveness of patient care. The fusion of Artificial Intelligence (AI) with the highly specialized field of oral and maxillofacial surgery represents a paradigm shift in modern healthcare [2]. This chapter delves into the profound significance of AI in the context of oral and maxillofacial surgery, where cutting-edge technology meets surgical precision to transform patient care. By harnessing the power of AI, oral and maxillofacial surgeons are embarking on a journey towards greater diagnostic accuracy, personalized treatment planning, enhanced surgical precision, and improved post-operative outcomes. Through insightful case studies, innovative applications, and a deep dive into the latest advancements, we will unravel the remarkable impact of AI on both the practice of surgery and the well-being of patients, ushering in an era where technology and healthcare converge to deliver superior and more compassionate patient care. What makes AI particularly significant in this context is its capacity to process colossal datasets and derive insights that surpass human capabilities. In oral and maxillofacial surgery, this translates into the ability to make more accurate diagnoses, predict treatment outcomes with greater precision, and craft highly individualized surgical plans. AI's prowess in image analysis allows for the detection of subtle anomalies and the precise assessment of complex facial structures, enabling surgeons to make informed decisions that were previously inaccessible [3].

Moreover, AI does not remain confined to preoperative planning. It has extended its influence into the operating room itself. AI-driven robotic systems and augmented reality technologies provide surgeons with real-time, dynamic guidance during procedures [4]. These systems, fuelled by advanced computer vision and machine learning, assist in instrument positioning, tissue differentiation, and complex anatomical navigation. The result is a profound enhancement in surgical precision, reduced intraoperative complications, and ultimately, improved surgical outcomes. Beyond the surgical theatre, AI also transforms post-operative care. Monitoring systems, equipped with AI algorithms, continuously track patient recovery, detecting early signs of complications and enabling prompt interventions [5]. This proactive approach minimizes the risks of post-operative complications, reduces hospital readmissions, and ensures patients receive the highest level of care throughout their recovery journey.

An Overview of the Key Milestones and Developments in the History of AI in OMFS:

The history of AI (Artificial Intelligence) in Oral and Maxillofacial Surgery (OMFS) is relatively recent but has been marked by significant advancements in a relatively short period.

Early 2000s: The use of computer-assisted surgical planning systems began in OMFS. These systems utilized computer algorithms to assist with treatment planning for craniofacial surgeries.

2005: 3D imaging and computer simulation tools started to be integrated into OMFS. These technologies allowed for more accurate diagnosis and treatment planning, laying the groundwork for AI integration.

2010s: Machine learning algorithms started to gain traction in healthcare, including OMFS. Researchers began exploring how AI could enhance diagnostic accuracy and optimize surgical procedures.

2013: IBM's Watson, a powerful AI platform, gained attention for its potential applications in healthcare. OMFS professionals started exploring the use of Watson for decision support in complex cases.

2016: The development of AI-powered dental imaging tools began to accelerate. These tools aimed to automate the analysis of dental X-rays and scans, aiding in the diagnosis of oral health conditions.

2018: Research in the application of AI for facial recognition and analysis gained momentum. AI algorithms were used to detect and diagnose craniofacial abnormalities and pathologies.

2019: AI-driven robotic surgical systems, such as the da Vinci Surgical System, started to be explored in OMFS. These systems enabled more precise and minimally invasive surgeries.

2020s: AI applications in OMFS expanded further. Researchers and practitioners began using AI for patient-specific treatment planning, surgical simulation, and predictive analytics to improve outcomes and patient care.

On-going Advancements: The integration of AI in OMFS continues to evolve, with ongoing research and development in areas like natural language processing (NLP) for patient communication, the use of AI in orthognathic surgery planning, and AI-enhanced medical records management.

It's important to note that AI in OMFS is part of a broader trend in healthcare, where AI technologies are being increasingly integrated into medical practice to enhance patient care, improve surgical precision, and streamline healthcare processes. The field is dynamic, and as AI technologies continue to advance, their applications in OMFS are likely to expand even further in the coming years.

Use of Artificial Intelligence in Oral and Maxillofacial Surgery:

Artificial Intelligence (AI) has found a wide range of applications in oral and maxillofacial surgery, revolutionizing various aspects of patient care, surgical precision, and overall efficiency. Here are some key ways AI is being used in this specialized surgical field:

Diagnostic Accuracy: AI algorithms are capable of analyzing medical images such as X-rays, CT scans, and MRI scans with remarkable accuracy. They assist in early and precise diagnosis of conditions like oral cancers, dental abnormalities, and craniofacial deformities, allowing for earlier intervention and better outcomes.

Treatment Planning: AI aids in developing personalized treatment plans based on a patient's unique anatomy and medical history. Surgeons can simulate procedures and anticipate potential complications, resulting in more efficient and precise surgeries, especially in complex cases like orthognathic surgery or dental implant placements.

Surgical Navigation: AI-powered surgical navigation systems offer real-time guidance during procedures. Surgeons can visualize critical structures, instrument positioning, and key metrics, improving surgical accuracy and reducing the risk of errors, particularly in procedures involving delicate structures like nerves and blood vessels.

Robot-Assisted Surgery: Robotics, driven by AI, enables highly precise and minimally invasive surgeries. Robotic systems can assist in tasks such as dental implant placement and tumour removal, enhancing the surgeon's dexterity and control [4].

Patient-Specific Implants and Prosthetics: AI is used to design and fabricate patient-specific implants and prosthetics, ensuring a perfect fit and optimal functionality. This is particularly valuable in cases of facial reconstruction and dental implantology [6].

Predictive Analytics: AI algorithms can analyze patient data to predict surgical outcomes and post-operative complications, allowing for proactive measures and personalized post-operative care plans.

Telemedicine: AI-powered telemedicine platforms facilitate remote consultations and collaboration among oral and maxillofacial surgeons. Experts from different locations can share insights, review complex cases, and provide second opinions, leading to improved patient care.

Electronic Health Records (EHRs): AI streamlines the management of electronic health records, automating administrative tasks and ensuring quick access to critical patient information. This efficiency allows surgeons to focus more on patient care.

Patient Monitoring: AI-driven monitoring systems track patients' recovery progress after surgery, detecting early signs of complications. This real-time monitoring enhances patient safety and reduces the need for readmissions [7].

Research and Data Analysis: AI assists researchers by analyzing large datasets of clinical outcomes, enabling the identification of trends, refining surgical techniques, and facilitating the development of new treatments and technologies.

In summary, AI's applications in oral and maxillofacial surgery are diverse and transformative. By enhancing diagnostic precision, treatment planning, surgical navigation, and post-operative care, AI not only improves patient outcomes but also empowers surgeons with tools that augment their capabilities. As AI technology continues to advance, its role in reshaping and advancing this surgical field is likely to expand, ultimately leading to safer, more efficient, and more personalized care for patients.

Challenges in the Use of Artificial Intelligence in Oral and Maxillofacial Surgery [8]:

The integration of Artificial Intelligence (AI) in oral and maxillofacial surgery (OMFS) holds great promise, but it also presents several challenges that need to be addressed for successful implementation.

Here are some of the key challenges in the use of AI in OMFS:

Data Quality and Quantity: AI algorithms require large amounts of high-quality data for training and validation. In OMFS, obtaining comprehensive and diverse patient data, including medical images and surgical records, can be challenging due to privacy concerns, data fragmentation, and the need for consent.

Interoperability: Integrating AI systems with existing healthcare infrastructure and Electronic Health Records (EHR) can be complex. Ensuring seamless data exchange and compatibility between AI solutions and various hospital systems is crucial but often difficult to achieve.

Regulatory Compliance: OMFS is subject to strict regulatory and ethical standards. Compliance with regulations such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States and similar regulations in other countries is essential when handling patient data in AI applications.

Data Privacy and Security: Protecting patient privacy and securing sensitive medical data is paramount. AI systems must be designed to maintain data privacy and security, with robust encryption and access control mechanisms.

Ethical Considerations: Decisions made by AI systems can have significant implications for patients. Ensuring the ethical use of AI in OMFS, including transparency in decision-making and addressing biases, is essential to maintaining trust among patients and healthcare providers.

Limited Generalization: AI models trained on one patient population or dataset may not generalize well to different demographics or clinical settings. Ensuring that AI solutions are adaptable and accurate across diverse patient groups is a challenge.

Validation and Clinical Trials: The development and validation of AI algorithms for clinical use require rigorous testing and validation in real-world scenarios. Conducting large-scale clinical trials to demonstrate the safety and efficacy of AI systems in OMFS can be time-consuming and resource-intensive.

User Acceptance: Healthcare professionals, including oral and maxillofacial surgeons, must be willing to adopt AI technologies. Overcoming resistance to change and ensuring that AI solutions align with the workflow and preferences of surgeons and other healthcare staff is a critical challenge.

Cost and Resource Constraints: Implementing AI in OMFS can be costly, from the acquisition of AI software and hardware to staff training. Smaller healthcare facilities may face resource constraints that limit their ability to adopt AI solutions.

Liability and Legal Issues: Determining liability in cases where AI systems are involved in patient care can be complex. Clear legal frameworks and guidelines are needed to address liability concerns and ensure accountability.

On-going Maintenance and Updates: AI models require continuous monitoring, maintenance, and updates to remain effective and up-to-date with evolving medical knowledge and standards. Ensuring the sustainability of AI systems in OMFS is a long-term challenge.

Education and Training: Preparing healthcare professionals, including surgeons, to use AI effectively is crucial. Providing comprehensive training and education programs to ensure that they can maximize the benefits of AI tools is an on-going challenge.

Despite these challenges, the potential benefits of AI in OMFS, including improved diagnostic accuracy, surgical precision and patient outcomes, make it a field ripe for continued exploration and innovation. Addressing these challenges requires collaboration between healthcare institutions, technology developers, policymakers, and researchers to develop ethical, secure, and effective AI solutions that can truly enhance the practice of oral and maxillofacial surgery.

A Step-by-Step Guide on How to Work on The Development of Artificial Intelligence in OMFS [9]:

Developing AI in Oral and Maxillofacial Surgery (OMFS) involves a collaborative effort that includes OMFS specialists, AI researchers, software developers, and healthcare institutions.

Identify Specific Use Cases: Begin by identifying the specific areas in OMFS where AI can make the most significant impact. This could include diagnostic support, treatment planning, surgical simulations, or post-operative monitoring.

Form Multidisciplinary Teams: Create teams that consist of OMFS specialists, AI researchers, data scientists, and software developers. Collaboration between experts from diverse backgrounds is crucial for successful AI development.

Data Collection and Annotation: Collect high-quality and diverse datasets relevant to OMFS. These datasets may include medical images (X-rays, CT scans, MRIs), patient records, surgical notes, and 3D models of craniofacial structures. Annotate and clean the data to ensure it's suitable for AI training and validation [10].

AI Model Development: Develop AI models tailored to OMFS applications. This involves selecting appropriate machine learning algorithms (e.g., convolutional neural networks for image analysis) and training them using the collected data. Continuously refine and fine-tune the models to improve accuracy and performance [10].

Clinical Validation and Integration: Collaborate with OMFS specialists to validate AI models in clinical settings. Conduct pilot studies and clinical trials to assess the AI system's effectiveness in real-world scenarios.

Ensure seamless integration of AI tools into the OMFS workflow, minimizing disruption to existing processes.

Ethical and Regulatory Compliance: Adhere to ethical guidelines and regulatory requirements for AI in healthcare. Protect patient data privacy and ensure transparency in AI decision-making processes. Collaborate with legal experts to navigate healthcare regulations.

User-Friendly Interfaces: Develop user-friendly interfaces for OMFS specialists to interact with AI tools. These interfaces should be intuitive, and training sessions may be necessary to ensure effective use.

Continuous Improvement: Implement mechanisms for continuous improvement of AI models and tools. Regularly update algorithms and retrain models with new data to keep them up-to-date. Gather feedback from OMFS practitioners to make refinements based on their experiences.

Knowledge Dissemination: Share research findings and developments in AI in OMFS through academic publications, conferences, and workshops. Collaborate with professional organizations and societies in OMFS to promote awareness and knowledge dissemination.

Educational Initiatives: Establish educational programs and workshops to train OMFS specialists in the use of AI tools and technologies. Offer opportunities for OMFS professionals to gain hands-on experience with AI applications.

Funding and Resources: Secure funding from research grants, private institutions, or government agencies to support AI development projects in OMFS. Allocate resources for hardware, software, and personnel.

Collaboration with Industry Partners: Collaborate with healthcare technology companies and start-ups specializing in AI to leverage their expertise and resources.

Explore partnerships for co-development and deployment of AI solutions.

Patient-centered Approach: Keep patient care and safety at the forefront of AI development efforts. Ensure that AI tools enhance patient outcomes and experiences.

Working on the development of AI in OMFS is a dynamic process that requires ongoing collaboration, a commitment to ethical principles, and a dedication to improving patient care and surgical outcomes through innovative technology.

Conclusion:

In summary, AI in Oral and Maxillofacial Surgery (OMFS) is a transformative force, enhancing diagnosis, precision, and patient care. It empowers surgeons with data-driven insights, streamlines workflows, and ultimately leads to safer and more effective surgical interventions. Despite challenges, the significance of AI in OMFS is undeniable, promising improved outcomes and a brighter future for both practitioners and patients.

References:

1. Karishma Rosann Pereira, Ramen Sinha. Welcome the “new kid on the block” into the family: artificial intelligence in oral and maxillofacial surgery. *British Journal of Oral and Maxillofacial Surgery*. 2020; 58(1):83-84.
2. Leslie R. Halpern DDS, MD, PhD, MPH, FACS, FICD, Eric R. Carlson DMD, MD, EdM, FACS. Education in Oral and Maxillofacial Surgery: An Evolving Paradigm. *Oral and Maxillofacial Surgery Clinics of North America*. 2022; 34:8-9.
3. Deepak G. Krishnan DDS. Artificial Intelligence in Oral and Maxillofacial Surgery Education. *Oral and Maxillofacial Surgery Clinics of North America*. 2022; 3(4):585-59.
4. W. Korb, R. Marmulla, J. Raczekowsky, J. Mühling, S. Hassfeld. Robot in operating theatre-chances and challenges. *International Journal of Oral & Maxillofacial Surgery*. 2004; 33(8):721-732.
5. Simon Rasteau, Didier Ernenwein, Charles Savoldelli, Pierre Bouletreau. Journal of Stomatology. Artificial intelligence for oral and maxillofacial surgery: A narrative review. *Oral and Maxillofacial Surgery*. 2022; 123(3):276-282.
6. Balaji, S. M. Maxillofacial Surgery and Artificial intelligence. *Annals of Maxillofacial Surgery*. 2023;13(1):1-2.
7. Leon A. Assael DMD. Residency Education in Oral and Maxillofacial Surgery: A New Curriculum Framework. *Oral and Maxillofacial Surgery Clinics of North America*. 2022; 34(4):537-544.
8. Grillo R, Reis BA, Melhem-Elias F. The risks and benefits of utilizing artificial intelligence in oral and maxillofacial surgery. *Journal of stomatology, oral and maxillofacial surgery*. 2023 May 4:101492.
9. Peter Rekawek BS, Chamith S. Rajapakse PhD, Neeraj Panchal DDS, MD, MA. Artificial Intelligence: The Future of Maxillofacial Prognosis and Diagnosis? *Journal of Oral and Maxillofacial Surgery*. 2021; 79(7):1396-1397.
10. Ruud Schreurs, MSc, Frank Wilde, MD, DDS, Alexander Schramm, MD, DDS, Nils-Claudius Gellrich, MD, DDS. Intraoperative feedback and quality control in orbital reconstruction. *Atlas of the Oral & Maxillofacial Surgery clinic*. 2021; 29(1):97-108.

About The Editors



Dr. C. Balalakshmi is currently working as Assistant Professor in the Department of Nanoscience and Technology, Alagappa University, Tamilnadu (India). she has 7 years of enriched teaching experience for postgraduate levels. Her field of research is Nano Marine Biology, Bio Nano Materials, Nano Green Biology, Nano Medical Bio Technology, Nano Anti Coating, Food Packaging Application. she has completed several " RUSA 2.0 Theme Based Research Project Grant Allocation" research funded projects. she has more than 19 publications to her credit in peer reviewed indexed journals. she has been recognized 'Guide' for M.Phil and Ph.D Students. she is also a Editorial Board Member of Innovative Scientific research Professional, Malaysia and Editor Member of Global Management Council- Glacier Journal of Research Foundation, Ahmedabad, Gujarat and Life Member of Indian Science Congress Association at Kolkata and Membership in Asia's Who's Who, Asian Biographies, Rifacimento International, New Delhi.



Dr. Parvathy Unnikrishnan (BAMS, MS. Ay) is currently working as Assistant Professor, Department of Striroga and Prasutitantra (Gynaecology & Obstetrics), Amrita School of Ayurveda, Kollam, Kerala. She has completed Fellowship in Epidemiology and Biostatistics course conducted by Medvarsity in association with School of Public Health and Community Medicine, University of New South Wales, Australia. She has also completed Psychology Counselling Course conducted by NHCA, Singapore. She has 6 years of Post graduate and undergraduate teaching experience and has been teaching NEET PG aspirants from different medical colleges. Her areas of interest include Health statistics, Data analysis, Bioethics, Pain Management in Ayurveda and psychotherapy. She is very much focused to educate the female community about healthy lifestyle through awareness programmes thereby extending the medical service to them. She has published 20 plus research articles in various Scopus and PubMed indexed National and International Journals. She has received "AyurVisharada" award from Himalaya Herbal health care for academic excellence in the year 2012 and received AIRA (Amrita Innovation & Research Award 2021) Certificate of Appreciation for publishing a research paper in an International Journal in 2020. She has been awarded for best paper presentation(s) in both national and international conferences. She is also a Member of Institutional Ethics Committee (IEC) at Amrita School of Ayurveda



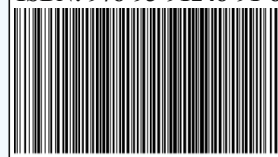
MKSES PUBLICATIONS LUCKNOW, INDIA

Address: Head office: 1st Floor, Building No-85A,
(Nanak Arcade Near Shani Mandir, Parag road,
LDA Colony, Kanpur Road, Lucknow-226012
Mobile No: +919838298016, +918299547952
office Land line No: +91 5223587193
E-mail: mkespublication@gmail.com
Website : mkespublications.com

Available on →



ISBN: 978-93-91248-91-8



PRICE
INR (₹): 399/-
USD (\$): 10/