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Brain Tumor in Pediatric Glioblastoma: Review Article

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ABSTRACT

Introduction: Glioblastoma (GBM) is a malignant brain tumor that can occur in children and is very aggressive which means it can grow and spread quickly. Approximately 16% of all primary brain and central nervous system neoplasms are glioblastomas. The incidence of glioblastoma in children varies. Glioblastoma *Low-grade* has a higher incidence in children aged 0 to 14 years, which is 1.8/100,000 while *high-grade* glioblastoma is 0.5/100,000 lower than *low-grade glioblastoma.*

Content: GBM develops more frequently in children with specific genetic syndromes, such as neurofibromatosis 1 (NF1), Li-Fraumeni syndrome, hereditary nonpolyposis colon cancer, and tuberous sclerosis.

Conclusion: In children, central nervous system tumors are the most common, with 3-15% being glioblastomas. In addition, the prognosis is also poor with high morbidity and mortality so to improve the patient's quality of life, effective therapy is needed. Therapy can be in the form of surgery, radiotherapy, or chemotherapy.

Keywords: Pediatrics; brain tumors; glioblastoma

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Introduction

Glioblastoma (GBM) is a malignant brain tumor that can occur in children and is very aggressive which means it can grow and spread quickly. Approximately 16% of all primary brain and central nervous system neoplasms are glioblastomas.[1] Glioblastomas are formed from cells called astrocytes that function as support for nerve cells. Glioblastoma can occur at any age.[2]

GBM develops more frequently in children with specific genetic syndromes, such as neurofibromatosis 1 (NF1), Li-Fraumeni syndrome, hereditary nonpolyposis colon cancer, and tuberous sclerosis.(1) However, most cases of GBM have no known cause. However, there were no risk factors that played a major role in causing glioblastoma. Although GBM is a rare tumor with a global incidence of less than 10 per 100,000 people, GBM still has a poor prognosis with a survival rate of 14-15 months after diagnosis. This makes GBM a major public health problem.[2]

GBM accounts for about 50% of all gliomas in all age groups. The incidence ratio of GBM is higher in men compared to women. The incidence of glioblastoma in children varies. Glioblastoma *Low-grade* has a higher incidence in children aged 0 to 14 years, which is 1.8/100,000 while *high-grade* glioblastoma is 0.5/100,000 lower than *low-grade glioblastoma.* where the incidence rate of glial and neuroepithelial tumors is higher in children aged 0-14 years.[3] Glioblastoma usually presents with non-specific symptoms and lasts a short duration of several months. In addition, the prognosis is also poor with high morbidity and mortality to improve the patient's quality of life, effective therapy is needed. Therapy can be in the form of surgery, radiotherapy, or chemotherapy.[6]

Definition

Glioblastoma (GBM) is a malignant brain tumor that can occur in children and is very aggressive which means it can grow and spread quickly. About 3,540 brains and CNS (central nervous system) tumors are diagnosed in children aged 0-14 years.[3] Approximately 16% of all primary brain and central nervous system neoplasms are glioblastomas.[1] Glioblastomas are formed from cells called astrocytes that function as support for nerve cells. Glioblastoma can occur at any age.[2]

Epidemiology

GBM accounts for about 3-15% of primary central nervous system (CNS) tumors. in children. It is inseparable that tumors that occur in the CNS are the most common in childhood and 40-50% of these tumors are formed by astrocytomas. Pediatric glioblastoma (p-GBM) has substantial morbidity and mortality, with the median survival reported for p-GBM ranging from 13-73 months with a 5-year survival of less than 20%. The survival rate for p-GBM has a longer life span than GBM in adults.[1]

Glioma is the most common central nervous system (CNS) tumor in children and adolescents with a very broad clinical picture. Pediatric gliomas are mostly benign slow-growing lesions classified as class I or class II tumors of the CNS. These pediatric low-grade gliomas (LGG) are inherently rare with malignant transformation and show good survival under current treatment strategies. however, most gliomas develop in a short time and grow rapidly so that they are classified as high-grade gliomas by WHO i.e. grade III or IV.[4]

CNS tumors are the 2nd most common childhood tumor after leukemia, it is estimated that the overall incidence of primary CNS tumors in childhood is estimated at around 30/1,000,000 people. While astrocytic tumors account for 40–50% of the CNS in children, high-grade gliomas are relatively rare.[5] According to the 2012 Central Brain Tumor Registry of the United States (CBTRUS) data, the incidence of high-grade glioma in pediatrics is approximately 0.85/100,000 cases. Most investigators estimate the incidence of high-grade gliomas in pediatrics to be between 8-12%. The incidence of p-GBM is estimated to be 3–15% at various ages in children and GBM is most commonly reported in the second decade of life.

The location of p-GBM often occurs in the supratentorial brain region, in the spinal cord it occurs in high-grade gliomas, which is about 3%, whereas involvement of the supratentorial compartment occurs in almost 50% of cases. The incidence of involvement of the structures of the thalamus, corpus callosum, hypothalamus has a low incidence. In the infratentorial compartment of the cerebellum, it is about 1-2% with a rare incidence of p-GBM, whereas in high-grade gliomas that occur in the brainstem, it is almost 20% of intrinsic tumors.[5]

Although GBM is a rare tumor with a global incidence of less than 10 per 100,000 people, GBM still has a poor prognosis with a survival rate of 14-15 months after diagnosis. This makes GBM a major public health problem. GBM accounts for about 50% of all gliomas in all age groups.[3] According to *the international classification of childhood cancer* (ICCC), the incidence of glioblastoma in children varies. Glioblastoma *Low-grade* has a higher incidence in children aged 0 to 14 years, which is around 1.8/100,000 while *high-grade* is 0.5/100,000 lower than *low-grade* glioblastoma, where the incidence rates of glial and neuroepithelial tumors are higher. higher in children aged 0-14 years and decreases in late adolescents aged 15-19 years, then increases with age. The histologic subtype of glioblastoma with the highest incidence in children is pilocytic astrocytoma. Astrocytoma and Glioblastoma NOS have the highest incidence in children aged 0-9 years with a decreasing incidence until the age of 19 years.[5]

Etiology

Various factors such as genetic and environmental factors have been studied in terms of the etiology of glioblastoma. GBM develops more frequently in children with specific genetic syndromes, such as neurofibromatosis 1 (NF1), Li-Fraumeni syndrome, hereditary nonpolyposis colon cancer, and tuberous

sclerosis. However, most cases of GBM have no known cause. However, there were no risk factors that played a major role in causing glioblastoma.[7] Until recently exposure to high doses of ionizing radiation was the only thing that could indicate an increased risk of developing gliomas. Other environmental exposures to vinyl chloride, pesticides, smoking, petroleum refining, synthetic rubber manufacture, electromagnetic fields, formaldehyde, and nonionizing radiation from cell phones have been linked to the development of gliomas but these factors have not been shown to cause GBM. An increased risk of developing gliomas is seen in certain genetic diseases, such as neurofibromatosis, tuberous sclerosis, Li-Fraumeni syndrome, retinoblastoma, and Turcot syndrome. However, less than 1% of patients with gliomas have the disease in question.[1,3]

To date, exposure to high doses of ionizing radiation is the only confirmed risk factor. Since the 1960s more than 116 cases of GBM have been reported as a result of radiation exposure and it has been estimated that the overall risk of developing GBM after radiotherapy is 2.5%. In addition, it has been reported that relatively low radiation doses used to treat tinea capitis and cutaneous hemangiomas in children or infants have been associated with a relative risk for glioma.[8] The extensive retrospective cohort data also clearly demonstrate an increased risk of glioma in the pediatric population after exposure to therapeutic intracranial radiation, which is dependent on patient age and radiation dose/volume. Glioma is also passed down through genes in families, but the susceptibility gene has not been identified. Rare genetic disorders including neurofibromatosis type 1 and type 2, tuberous sclerosis are have been found to be associated with an increased incidence of gliomas.[3]

Pathogenesis

Pathogenesis associated with glioblastoma can be seen from the genetic and molecular aspects. Fact, *the World Health Organization* (WHO) has a classification system based on subtypes of glioblastoma based on histological and immunohistochemical similarity to the cell of origin. This grading is also formed based on histological features related to the level of biological aggressiveness such as necrosis, mitotic features and hyperplasia of the vascular endothelium.[11]

The clinical characteristics of glioblastoma can be divided into primary and secondary. Primary glioblastoma presents de novo without clinical evidence,and the precursor lesion is histological. Changes that occur in primary glioblastoma are mutations and amplification of the *epidermal growth factor receptor* (EGFR) gene, overexpression of *mouse double minute* (MDM2), depletion of P16,and *loss of heterozygosity* (LOH) of chromosome 10q which carries *phosphatase and tensin. homologous* (PTEN) and TERT promoter mutations.[15] Meanwhile, secondary glioblastoma arises due to the slow development of astrocytoma that previously existed. The changes that occur are overexpression of *platelet-derived growth factor A* and *platelet-derived growth factor receptor alpha* (PDGFA/PDGFRa), retinoblastoma (RB, LOH 19q and

IDH1/2, TP53 and ATRX mutations). These genetic lesions can be grouped into 3 main signaling pathways namely; altered receptor tyrosine kinase/RAS/PI3K, P53 pathway and RB signaling pathway.[12]

The existence of these genetic change affects cell proliferation and tumor growth with a cascade of mutations in each pathway. In addition, genetic changes also affect the occurrence of angiogenesis. In Glioblastoma, genetic abnormalities will cause morphological changes such as infiltration, necrosis with pseudo palisade, and microvascular proliferation. Neoplastic cells secrete procoagulant proteins that are responsible for endothelial injury and intravascular thrombosis.[5] Intravascular thrombosis can cause hypoxia as well as perivascular tumor necrosis with tumor cell pseudo palisade, an adaptation to hypoxic conditions. Pseudo palisade will express *hypoxia-inducible factor-1a* (HIF-1a) in excess, which will have an impact on the migration of glioblastoma cells from damaged blood vessels. In the presence of proangiogenic factor secretory factors, tumor cells further expand into newly formed blood vessels. In addition to the above factors, there is also the role of inflammatory cytokines, chemokines, and *growth factors* that help modulate proliferation, infiltration and angiogenesis, as well as tumor growth.[9] The study stated that in the area around the growth of glioblastoma tumors there were increased levels of IL-6, IL-8, and IL-1B associated with cell proliferation and decreased *survival rate* patient. [13]

Clinical Manifestations

Symptoms of glioblastoma are non-specific. The duration of symptoms is usually short and lasts for several months.[6] The most common symptoms are headache, nausea and vomiting, and diplopia. Children with glioblastoma usually present with acute neurologic deterioration resulting from intratumoral hemorrhage.[7] Thus, if CNS symptoms are found in pediatric patients, it is necessary to suspect a brain tumor.[8] Infants and young children usually have difficult-to-diagnose symptoms such as failure to thrive, lethargy, nausea and vomiting, and macrocephaly.[6] Patients with GBM have different signs and symptoms produced by three mechanisms, namely:

1. Direct effects, namely brain tissue damage due to necrosis that causes symptoms such as focal nerve deficits and cognitive impairment that lasts for days to weeks. If the tumor is large with a significant mass it can cause gait imbalance and incontinence.[3]
2. Secondary effects, this is related to the increase in intracranial pressure which is the result of a gradual increase in size and edema around the tumor causing intracranial displacement. The most common symptom can be a headache. Headaches usually have unilateral characteristics and do not have a specific pattern.[3] Headaches are often followed by other symptoms such as seizures, nausea and vomiting, blurred vision, changes in mental status, dysarthria and hemiplegia.[7]

3. The location of the tumor, basically the signs and symptoms caused depend on the area of the brain affected by the tumor. For example, patients who have seizure symptoms indicate that the tumor is located in the frontotemporal lobe area.[6] Meanwhile, in patients who come with changes in personality and cognitive function, the tumor is located in the frontal lobe area.[3]

Management

Surgery

Maximum surgical resection followed by chemoradiotherapy is still the best treatment for GBM today. Some studies have reaffirmed the utility of maximal tumor removal in both free progression and overall survival in p-GBM.[10,11] Study *Children's Cancer* showed that children with HGG who underwent surgical resection of 90% or more had a progression-free survival of 35 ± 7% compared with a 5-year progression-free survival of 17 ± 4% in patientswho do not.[13] It was also reported in a study that p-GBM single-center experiences suggest that the extent of tumor excision is a strong predictor of progression-free long survival as well as overall survival.[6] The utility of maximal surgical excision has been demonstrated in multiple propensity analyses, having scientific value as well as randomized clinical trials.[10] The degree of resection depends on the location and extent of the tumor.[6] Brainstem locations, midline supratentorial tumors, tumors involving the eloquent area, etc., are often difficult to completely excise without causing significant neurologic deficits. In addition to providing tissue for diagnosis, *debulking* reduces tumor-associated mass effects and potentiates the effects of adjuvant therapy. Different intraoperative imaging techniques allow wider excision of the tumor which in turn translates to better survival outcomes.[15]

These advanced techniques include intraoperative neural navigation, intraoperative ultrasonography, intraoperative MRI, intraoperative cortical mapping, etc. Recent technological advances using microfluidic chips allow rapid analysis of operative specimens for molecular markers such as IDH mutations in a short period of time.[13,15] Therefore, it is now possible to make a molecular diagnosis even intraoperatively. Such advances have the potential to facilitate intraoperative decision-making regarding future radicalism of surgical excision.[6]

1. Preoperative evaluation

Before admission to the operating room, all surgical candidates are required. Most surgical centers worldwide are required to sign an *informed consent.* For 1 month the patient is advised not to smoke and drink alcohol whenever possible. Preoperative evaluation of intracranial tumors should include an assessment of neurologic and general status. Assessing intracranial pressure (ICP) status is the primary goal in evaluating neurologic status. Preoperative steroids can be given to control ICP by reducing peritumoral edema. It is also worth monitoring for endocrine, muscular, skeletal, gastrointestinal, psychiatric and

hematological complications in the patient. Brain relaxation can be achieved by administering hypertonic saline or mannitol to increase the likelihood of intraoperative brain relaxation.[15]

2. Intravenous Anesthesia

Barbiturates have four actions in the brain: (i) hypnosis, (ii) depression of cerebral metabolic rate, (iii) reduction of cerebral blood flow, and (iv) anticonvulsant activity. All of these actions can produce significant hypotension.[15]

3. Muscle Relaxation

Neuromuscular blocking agents (*NMBAs*) have no direct effect on CMR, ICP, or CBF. *Pancuronium* can increase heart rate and mean arterial pressure (MAP). Succinylcholine may increase ICP in brain tumor patients, secondary to cerebral activation associated with fasciculations and increased muscle spindle activity; However, when administered together with the intravenous agent propofol, ICP can be reduced.[15]

4. Extension of Resection

The goal of resection is to remove as much of the tumor as possible to reduce the mass effect and to obtain brain tissue for pathological analysis. Tumor recurrence occurs within a 2 cm margin of the primary site in 90% of cases.[15]

5. Fluorescence Guided Surgery

5-ALA is a naturally occurring amino acid biosynthesized from glycine and succinyl-CoA in the mitochondria. After systemic administration, ALA in tumor cells is metabolized to protoporphyrin IX (PpIX), a photosensitizing porphyrin. PpIX levels were highly specific (98%) in the infiltrating tumor area and were highest at 6 hours after administration. 5-ALA is an orally administered product used for high-grade visualization of glioma tissue during surgery, enabling safer and more extensive tumor resection. Under the excitation of blue light (400-410 nm), tumor tissue appears red, whereas normal tissue (including edema) does not show fluorescence.[15]

6. Indocyanine Green

Angiography with *indocyanine green* (ICG) was first developed for ophthalmological purposes in 1956 to evaluate the choroidal microcirculation; Other uses are to assess liver function, live blood flow, and cardiac output. Near-infrared ICG video angiography was introduced in the field of neurosurgery to visualize cerebral blood vessels for aneurysm clipping, bypass, and vascular malformations. Superficial avascular areas in HGT have been seen during pre-resection ICG video angiography. neovascular architecture; changes in caliber, morphology, and direction of blood vessels; and hemodynamic patterns can be observed.

The dye does not penetrate the membrane and therefore cannot define tumor boundaries. ICG helps avoid injury by preserving small caliber vessels during brain tumor surgery.[15]

7. Neuronavigation

Systems have been developed for image-guided neurosurgery to aid in the accurate localization of lesions in the brain. Before craniotomy, the patient's head is secured to the head restraint with head pins; this fixation can cause skin shift (*skin shift*) and reduce accuracy which can be corrected using intraoperative imaging systems (CT and/or magnetic resonance imaging, MRI). The most widely used tracking systems use dual infrared cameras that track the position of the probe relative to a fixed frame of reference. Electromagnetic navigation relies on tracking probes in an electromagnetic field, created by a field generator at a fixed location. Using MRI, positional accuracy is within 2-3 mm during surgery. Neural navigation is most useful as an adjunct to other brain mappings techniques such as conscious mapping and electrocorticography in the resection of lesions in motor areas and fluent language. The use of intraoperative MRI can improve resection rates, quality of life, and survival in glioma patients.[15]

8. Postoperative care

The incidence of postoperative complications within 30 days of tumor resection was as follows: stroke (2.1%), myocardial infarction (1.3%), death (2.7%), infection (2.4%) , and the need for revision surgery (6.6%). Assisting early discharge from hospitals for cancer patients accelerates chemotherapy and/or radiotherapy and other treatments, potentially improving patient outcomes by reducing the period time between surgery and the resumption of daily activities. The bladder catheter should be removed on the first postoperative day or as early as possible. Postoperative artificial nutrition is usually not required in patients unless the patient is in a prolonged coma (>7 days).[15]

Radiotherapy

Radiotherapy is a complementary part of the comprehensive management of p-GBM. This is more because the role of chemotherapy is not yet clear in these patients, unlike their adult counterparts. Typically, radiotherapy doses ranging from 50 to 60 Gy are fractionated over 5-6 weeks. Experiments on hypo/hyper fractionation of the total dose did not show better results. It is routinely used in children older than 3 years. The main reason why it should not be used before 3 years of age is that RT can cause adverse neurocognitive complications due to its deleterious effects on the developing brain. In addition, it is believed that tumors in the early years of life are rather slow and less responsive to irradiation.[6]

Chemotherapy

Many chemotherapy regimens can be used for *LGG, HGG,* and recurrent gliomas. Chemotherapy appears to be a less effective modality when examined alone, offering a slight improvement in survival.[8] However, chemotherapy can be used because it has a cumulative effect which, when combined with other management strategies, can provide a dramatic increase in survival up to three times.[18] CCNU (*chloroethyl-cyclohexyl nitrosourea*) and *vincristine* are the main chemotherapeutic agents used with great effect in clinical trials, and PCV (*procarbazine, lomustine, and vincristine*) have also been reported to improve survival in pediatric glioma cases. *Temozolomide* (TMZ) is a standard chemotherapy modality that appears to increase survival by approximately 2 months in adults, but has failed to demonstrate a survival benefit in a pediatric trial. Chemotherapy with stem cell transplantation is a new modality in treating *HGG*, although its advantages have not been established over other treatment modalities.[8]

Conclusion

(GBM) is a malignant brain tumor that can occur in children and can grow and spread rapidly caused by both genetic and environmental factors. In children, central nervous system tumors are the most common, with 3-15% being glioblastomas. Glioblastoma usually presents with non-specific symptoms and lasts a short duration of several months.

GBM suffered by a young patient with a good clinical condition. The treatment is maximal resection followed by radiotherapy and adjuvant temozolamide given concurrently and after radiotherapy. The target volume and standard dose of radiation is 60 Gy in 30 administration fractions. In addition, the prognosis is also poor with high morbidity and mortality to improve the patient's quality of life, effective therapy is needed. Therapy can be in the form of surgery, radiotherapy, or chemotherapy.

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There is no conflict of interest

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Age Related Macular Degeneration in Coastal Communities: Review Article

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ABSTRACT

Introduction: Many parts of the Indonesian coastline are open areas while at the same time there's not many place to take shelter causing exposure to sun rays to become more frequent. This condition puts the people around the coasts at high risk of various eye diseases such as keratitis, cataract, and Age-related macular degeneration (AMD).

Content: AMD is a chronic eye disease that causes central vision impairment due to degeneration of the retina in the macula. 8 million of people are enduring blindness due to retina complications not excluding AMD. Blue light and ultraviolet light that is contained within sun rays are the main cause of harm to tissues in the retina and reduce vision function.

Conclusion: The disease is irreversible but therapy can slow the progression of the disease, including laser therapy and anti-VEGF. Preventive action is the best management that can be done for coastal communities. The best action that can be done currently is preventing it by holding counseling sessions and increasing public awareness through education.

Keywords: Macular degeneration; coastal area; ultraviolet

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Introduction

AMD is a chronic multifactorial eye disease that occurs due to disruption of the homeostatic mechanism or retinal cell apoptosis caused by chronic inflammation and oxidative stress resulting in the accumulation of lipid deposits, lipoproteins, and damage to the extracellular matrix[1]. Risk factors that cause AMD are genetic, diet, environmental factors such as sun exposure, lifestyle factors such as smoking and drinking alcohol, as well as medical factors such as cataracts and hypertension.[1]

AMD is the leading cause of blindness and visual impairment in the elderly population in Asian countries and worldwide. AMD is the third leading cause of blindness after cataracts and glaucoma with a contribution of about 8.7% of blindness in the world. The prevalence shows that around 196 million people in the world will experience visual impairment of AMD in 2020 with the incidence of AMD ranging from 1.4 to 3.5 per 1000 population.[1,2] There is currently no reliable data about the prevalence or incidence in Indonesia but it is predicted that the prevalence will double by 2050. [3,4]

Indonesia is an archipelagic country that has many coastal areas located on the equator, which is an area with consistent sun exposure throughout the year. The geographical location affects the exposure of sun radiation that enters the earth's surface. The more perpendicular the sun's rays, the more ultraviolet radiation (UVR) that reaches the earth's surface and the more cloudy or shady, the UVR will be smaller.[3]

Definition

Retina has several structures such as Bruch's membrane, retinal pigment epithelium (RPE), and photoreceptor. Bruch's membrane is an extracellular matrix located between the RPE and the choroid, and plays a vital role as structural and functional support to the RPE. RPE performs specialized metabolic functions including processing lipids from photoreceptor turnover, synthesizing and absorbing lipids from the circulatory system. These structures are very vulnerable to light radiation especially in the macula which is the focus of light refraction. Macula is an area in the center of the retina, which harbors the area of sharpest vision.[5]

The coastal area is a transitional area between dry land ecosystems. Coast is an area several tens to hundreds of meters from land affected by sea tides (shores) to wet marine ecosystems. Coastal areas are open areas that often get sunlight and few shaded areas, causing coastal communities to be at risk for AMD because of UVR. [3,6] The International Commission on Non-Ionizing Radiation Protection (ICNIRP) defines several subgroups of ultraviolet or invisible radiation classified into UVA (315-400 nm), UVB (280-315 nm) and UVC (100-280 nm). The higher the wavelength, the more dangerous because it contains higher energy that can damage DNA or create free radicals.[5,7,8]

Epidemiology

The prevalence of AMD in 2020 according to Wong et al is projected that 8 million people from 196 million population will experience blindness due to retinal complications including AMD.[2,9,10] Based on studies in the population aged 45-85 years, the average prevalence of AMD worldwide is around 8.7%, starting with the highest being 12.3% in Europe, 10.4% in North America, 7.5% in Asia and 7.5% in Africa.[1] The incidence of early-stage AMD is around 3.5 per 1000 population. Late-stage AMD is 1.4 per 1000 population. Dry type AMD and wet type AMD is 1.9 and 1.8 per 1000 population, respectively.[1,2,11]

Risk Factor

There are several risk factors for AMD in the coastal areas includinglifestyle and internal risk factors. Risk factors that correlate with personal habits or lifestyles are smoking, diet, and profession. Smoking increases the risk of developing AMD two to four times higher by affecting blood circulation health. The effects of smoking are, such as: lowering the amount of high-density lipoprotein, increasing fibrinogen, platelet aggregation, oxidative stress, and lipid peroxide, causing reduced plasma antioxidants and increasing levels of inflammations and cytokines.[1,9] Dietary consumption of lutein and zeaxanthin such as spinach, collard greens, kale, and consumption of fish oil or docosahexaenoic acid and eicosapentaenoic acid can reduce the risk of late stage AMD, but high sodium levels in marine fish and or due to high use of sodium salt in food processing in coastal communities, can increase the risk of hypertension and reduce the nutrients contained in these marine fish.[1,8] In addition, fisherman professional in the coastal area who fish during the day also increase the risk of AMD due to exposure to UVR through the reflection of the water or direct exposure.[5,12]

Internal risk factors include hypertension, age, and genetics. Hypertension can increase the risk of AMD because of its effect on blood vessels in the choroid. This increases the risk of vascular rupture leading to ischemia and retinal cell apoptosis in the macula.[1,9] Genetics contributes about 71% to increase the risk of developing AMD, which is higher than genetic influences on coronary heart disease.[1,8,9] Age is a risk factor that is strongly associated with the incidence of AMD. Studies show an increase in AMD cases from 3.5% at the age of 55-59 years to 17.6% at the age above 85 years.[1,13] Old age is a major risk factor for AMD because it is associated with structural and functional changes in the retina.[1,14]

Pathophysiology

The eye has a protective mechanism against UVR but under certain conditions and prolonged exposure, UVR still can reach and cause retinal damage. Ultraviolet C (UVC) is mostly absorbed by nucleotide bases and aromatic amino acids so that little passes through the cornea and lens but higher wavelengths, UVA and UVB, can reach and damage the retina. High doses of UVR cause photokeratitis and photo

conjunctivitis, low doses of chronic UVR can cause cataracts, pterygium, squamous cell carcinoma of the cornea and conjunctiva, and AMD.[1,5]

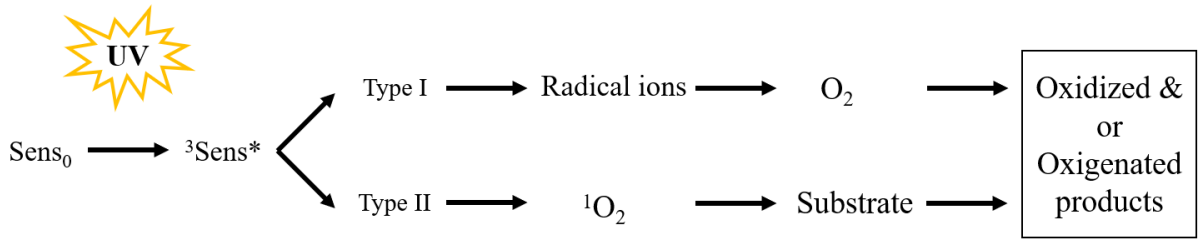

Figure 1. Diagram of ROS generation due to UVR exposure, type 1 and type 2 reaction.[5]

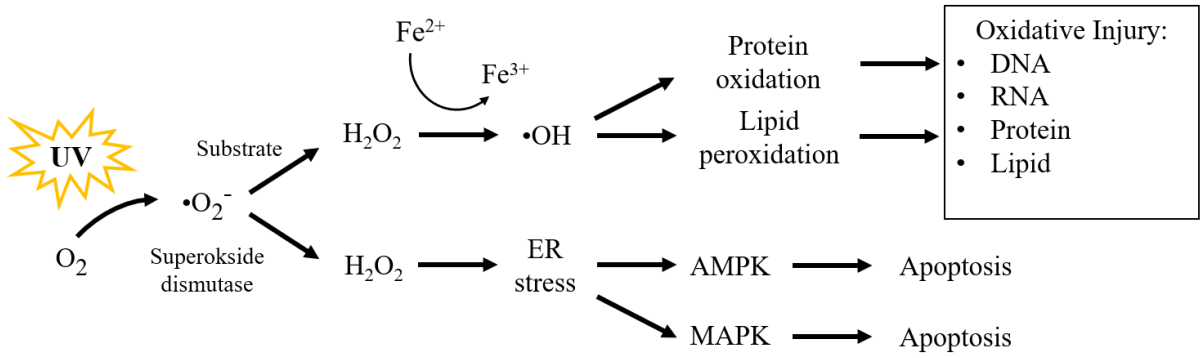

Figure 2. Diagram of ROS generation due to UVR exposure, delayed reaction.[5]

UVR can cause photochemical damage resulting in the formation of oxidation molecule in retina especially macula.[5,10] Retina is probably the tissue that contain the highest endogenous photosensitizers or chromophore that can be excited by light as a consequence, it is highly sensitive to oxidative damage. Chromophore molecules in the retina that can be oxidized are photoreceptor pigments, proteins, flavoproteins, and pigment granules melanin and lipofuscin. There are 3 different ways UVR excites chromophores and produces free radicals, type 1, 2, and delayed reactions. In type 1, after the chromophores are excited by UVR into a triplet state, it undergoes a direct electron or hydrogen exchange with the substrate, creating a free-radical intermediate. Then, this free-radical intermediate reacts with additional substrate or oxygen, which is available a lot in the retina, to create peroxidation products. In type 2, triplet chromophore directly reacts with oxygen without free-radical intermediate and produces singlet oxygen. In the end, these two type ways can produce reactive free radicals if they meet substrates like lipids in RPE and create peroxidation reaction products that damage nearby retina tissue. In the delayed type, UVR oxidizes oxygen into a superoxide radical. Then, it reacts with an additional substrate or superoxide

dismutase that generates the electric neutral hydrogen peroxide (H_2O_2). In the presence of some metal ions H_2O_2, a non-radical oxygen species forms the highly reactive and most powerful free radical (•OH). It's called delayed because it triggers delayed oxidative responses that may persist after irradiation is stopped. UVA can cause type 1 and type 2 reactions because it has higher energy to initiate oxidation through the photosensitization mechanism. Meanwhile, UVB can only generate delayed type reaction.[5]

Free radicals •OH reacts with other molecules such as lipids to form lipid peroxidation which damages the structure of cell membranes or reacts with protein molecules to form protein oxidase which can damage the sensorineural and retinal structure. Lifelong chronic exposure to UVR causes a build-up of oxidative damage that weakens the protective layer of the eye thereby contributing to macular degeneration.[5] In addition, accumulation of H_2O_2 also accelerates and stimulates the formation of ceramide-dependent cell apoptosis which induces endoplasmic reticulum stress that will initiate the activation of the AMP-activated protein kinase (AMPK) and mitogen-activated protein kinase that end in cell apoptosis cascades.[15]

Clinical Manifestations

Clinical Manifestations felt by patients include:

1. Difficulty seeing in low-contrast, dim, or dark-adapted conditions.[1,16]
2. Loss of ability to read and recognize faces.[1]
3. Decreased visual acuity (blurry) especially in the central visual field.[1,16]
4. Visual distortion (straight lines become wavy or distorted), objects appear larger or smaller.[1,9,16]

A physical examinations that can be tested include:

1. Decreased central visual field.[1]
2. Amsler grid test, the patient sees dots and straight lines become wavy or distorted.[9]
3. Funduscopic, early-stage AMD found fatty deposits (drusen) on the macula, late stage may reveal geographic macular atrophy in dry type AMD or wet type AMD it may be neovascular; fibrovascular, serous or hemorrhage retinal detachment, subretinal epithelial hemorrhage or fibrous tissue.[1]

Treatment and Management

AMD is an irreversible degenerative disease and available therapies only prevent the progression of wet-type AMD such as photodynamic laser therapy, photocoagulation, and anti-VEGF.[1,5,9] Therefore, counseling and education are the best way to manage AMD in coastal areas. By providing education and counseling, people can understand more about AMD so they can change lifestyle habits and take preventive measures. In addition, more specifically AMD prevention can be done by:

1. Conduct counseling related to risk factors, prognosis and complications, and the importance of maintaining eye health and routine eye health checks.[1]
2. Wearing sunglasses during the day.[12]
3. Routine physical activity and smoking cessation.[1,9,17]
4. Consumption of vegetables such as spinach, and collard greens which are high in lutein and zeaxanthin as antioxidants reduce free radicals caused by UVR and *polyunsaturated fat* reduces fat deposits in the macula.[1,9,18]
5. Consumption of vitamin C, vitamin E, beta carotene, and zinc can prevent and reduce 25% progression in the next 5 years.[1]

Conclusion

Indonesia is an archipelagic country with many coastal areas exposed to UVR throughout the year due to its geographical location. AMD is a multifactorial degenerative disease that one of the risk factors is sun exposure. This disease is characterized by a decrease in central vision without affecting peripheral vision. This disease cannot be cured but therapy can slow the progression of the disease, including laser therapy and anti-VEGF. Preventive action is the best management that can be done for coastal communities.

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REVIEW ARTICLE Open Access

Event of Nasopharyngeal Carcinoma in Coastal Area: Review Article

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ABSTRACT

Introduction: Communities in coastal areas have a high level of consumption of salted marine products, such as salted fish. Consuming salted fish is one of the factors causing the incidence of nasopharyngeal carcinoma (NPC).

Content: NPC is a type of cancer found in the head and neck that can be caused by various factors, such as smoking, formaldehyde exposure, and consumption of salted fish. Clinical manifestations can arise in the patient's NPC, such as epistaxis, nasal congestion, ringing in the ears, headaches, facial pain, and visible lumps

Conclusion: NPC is a type of cancer found in the head and neck that can be caused by various factors, such as smoking, formaldehyde exposure, and consumption of salted fish. Clinical manifestations can arise in the patient's NPC, such as epistaxis, nasal congestion, ringing in the ears, headaches, facial pain, and visible lumps

Keywords: Nasopharyngeal carcinoma; coastal area; salted fish

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Introduction

Indonesia is an archipelagic country that stretches from 60 North Latitude to 110 Latitude and 920 to 1420 East Longitude with a coastline of 81,000 km most of Indonesia's area is an ocean, so most of the area is an ocean. Most of Indonesia's territory consists of the coast.[2,12] Indonesia is a country consisting of islands and oceans that are rich in potential natural resources.[2] Abundant marine products make the Indonesian people empower fish catches into long-lasting salted fish processed foods. In research (Rusliafa, Amiruddin, and Noor, 2014), it has been found that people living in coastal areas have a higher level of sodium consumption due to the consumption of salted seafood compared to people living in the mountains. Eating salted foods, such as salted fish, is one of the factors causing the incidence of nasopharyngeal carcinoma.[7,8]

Nasopharyngeal carcinoma (NPC) is a type of cancer found in the head and neck.[9] NPC is the fourth most common malignant tumor in Indonesia after cervical cancer, breast cancer, and skin cancer.[15] Meanwhile, in the world, Indonesia ranks third for NPC cases with the highest number of occurrences. NPC originates from the epithelial surface of the nasopharynx, precisely in the narrow gap behind the nasal cavity above the back of the throat (Rossmuller fossa). Nasopharyngeal carcinoma, previously known as lymphoepithelioma.[9]

Besides being caused by fish consumption, this malignancy can also be caused by various factors, such as viruses, genetics, and environmental factors. [1] Among these factors, the consumption of salted fish is the most common cause of NPC due to its association with carcinogenic substances.[7]

Epidemiology

Nasopharyngeal carcinoma is an endemic disease in certain regions of the world, especially in Southeast Asia. According to data from the *World Cancer Research Fund International* (WCRFI), there were more than 133,000 new cases of nasopharyngeal cancer in 2020 with an average recorded prevalence of 1.5/100,000. Indonesia ranks third with the highest nasopharyngeal carcinoma in the world with an incidence of 6.8/100,000 people or there are 19,943 new cases of NPC every year. Meanwhile, the mortality rate of NPC in the world is 80,000 cases or there are 0.9/100,000 cases of death due to NPC in 2020. Indonesia ranks second highest after Brunei Darussalam with a prevalence of 0.9/100,000 or there are 13,399 deaths due to NPC in 2020.[14]

Risk Factors

NPC cases are most commonly found in men compared to women in the 45-55 year age group.[10] According to research from (Tsao et *al.*, 2014) states that male sex is 2-3 times more at risk of suffering from NPC compared to women.[13] Based on data from Global *Cancer Statistics* (GLOBOCAN) 2020, also stated that NPC in men was 3 times more than the number of NPC cases in women with a total of 96,371 new cases

in men and 36,983 new cases in women.[11] Age factors also increase the risk of this NPC incident. NPC cases began to increase in the population aged 30 years and cases peaked in the 40-60 year age group. After reaching the age of 60 years, the incidence of NPC began to decrease.[5,13]

Apart seen from age and gender, NPC cases are also often found in people with high consumption of salted fish.[4] In the study of Kasim and his colleagues, it was found that most of the NPC patients at Abdul Moeloek Hospital Bandar Lampung often consumed salted fish with a frequency of > 3 times a month.[4] Consumption of salted fish increases the risk of NPC because there are carcinogenic substances, namely nitrosamines that are in salted fish.[3]

Etiopathophysiology

This malignancy can be caused by various things, such as the interaction of environmental factors, genetic structure, and viral infections such as the Epstein-Barr virus, radiation exposure, nutritional deficiency, or a decrease in the immune system.[9] Environmental factors that can cause the incidence of NPC are environments that have a population of both passive and active smokers, formaldehyde exposure, and consumption of salted fish.[3] In endemic areas, there are many foods with high salt content, for example, salted fish, which contain nitrosamines and nitrites that trigger NPC events. The active carcinogenic ingredient of nitrosamines can cause DNA damage and chronic inflammation of the nasopharyngeal mucosa. Meanwhile, natural nitrites are not carcinogenic but will become carcinogens in the endogenous nitrosation process. Endogenous nitrosation occurs when nitrites react with amides and secondary amines to produce nitrosamides and nitrosamines which are active carcinogenic agents. Consuming these carcinogenic foods during childhood leads to the accumulation of genetic lesions as well as the development of cancer in the nasopharynx causing the occurrence of NPC.[6,13]

Clinical Manifestasions

Mostly, NPC appears in the fossa of Rosenmuller and spreads intracranially or locally as a mass in the head. Based on the anatomical location, NPC has 4 main symptom groups; namely first, nasal symptoms such as epistaxis, nasal obstruction, and rhinorrhea; second, ear symptoms such as ear fullness, hearing loss, and ringing in the ears (tinnitus) associated with eustachian tube dysfunction due to lateral-posterior tumor expansion; third, cranial nerve palsy due to tumor expansion into the para cavernous sinus which causes disturbances in N 3, 5, 6, and 12. Clinical manifestations that appear in this third group, namely patients complaining of headache, eye movement disorders, diplopia, swallowing disorders, facial pain, and facial numbness; Fourth, neck symptoms, the manifestation of which is usually the patient presents with a complaint of a lump or enlargement of the lymph nodes at the top of the neck and there can be a mass in the rosenmuller fossa with posterior rhinoscopy examination. NPC patients can experience one or more of these 4 groups of symptoms.[1]

Classification

In determining the staging of NPC can use the *American Joint Committee on Cancer* (AJCC) 2017 or the 8th edition of the TNM classification system as described in the following table.[9]

Table 1. Nasopharyngeal Carcinoma Classification System based on TNM Stage 8th edition/ AJCC 2017. [9]

Primary Tumor (T)	
TX	Primary tumors cannot be graded
T0	No tumor was identified, but cervical node involvement is EBV positive
T1s	Carcinoma *in situ*, there is no invasive tumor
T1	Tumor confined to the nasopharynx, oropharynx, or nasal cavity without para pharyngeal extension
T2	Tumor with extension to the para pharynx, involvement of surrounding soft tissues (medial pterygoid, lateral pterygoid, prevertebral muscle)
T3	Tumor with infiltration of bony structures at the base of the skull, cervical spine, and/or paranasal sinuses
T4	Tumor with intracranial extension, involvement of cranial nerves, hypopharynx, orbit, parotid gland, and/or extensive soft tissue involvement across the lateral surface of the lateral pterygoid muscle
Regional lymph nodes (N)	
NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastases
N1	Unilateral or bilateral or unilateral metastases to cervical and/or cervical lymph nodes, metastases to retropharyngeal lymph nodes, < 6 cm, above the caudal border of the cricoid cartilage
N2	Bilateral metastases to cervical lymph nodes, < 6 cm, above the caudal border of the cricoid cartilage

N3	Unilateral or bilateral metastases to cervical lymph nodes, > 6 cm, and/or spread below the caudal margin of the cricoid cartilage
Metastatic (M)	
M0	No distant metastases
M1	There are distant metastases
Stage Grouping	
Stage 0	T1s-N0-M0
Stage I	T1-N0-M0
Stage II	T1-N1-M0 and T2-N0, N1-M0
Stage III	T1, T2, T3-N2-M0 and T3-N0, N1, N2-M0
Stage IVA	T4-any N-M0 and Any T, N3-M0
Stage IVB	Any T-any N, M1

Management

Treatments that can be used to treat NPC include radiotherapy, chemotherapy, and surgical intervention. The main treatment that can be done in dealing with NPC is radiotherapy. Radiotherapy is effective in all cases of NPC except in cases of NPC that have distant metastases. While chemotherapy treatment is usually done together with radiation at an advanced stage. Chemotherapy can also be done in cases of NPC that have metastasized far. When radiotherapy and chemotherapy are unsuccessful and relapse occurs, surgical intervention can be used as a salvage option.[9]

Conclusion

Nasopharyngeal carcinoma (NPC) is a type of cancer found in the head and neck. NPC is the fourth most common malignant tumor in Indonesia after cervical cancer, breast cancer, and skin cancer. This malignancy can be caused by various things, such as the interaction of environmental factors, genetic structure, and viral infections such as the Epstein-Barr virus, radiation exposure, nutritional deficiency, or a decrease in the immune system. NPC cases are most commonly found in men compared to women in the elderly age group, in the range of 45-55 years. Several treatments such as radiotherapy, chemotherapy, and surgical intervention can be done to treat NPC cases.

Conflict of Interest

There is no conflict of interest

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ORIGINAL ARTICLE Open Access

Risk Factors Typhoid Fever Incidence at Lau Health Center, Kecamatan Lau, Maros 2021

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ABSTRACT

Introduction: Typhoid fever is a disease caused by the bacterium Salmonella typhi. Until now, disease fever typhoid still is problem for health in tropical countries including Indonesia. Knowing risk factor incident fever Typhoid at the Lau Public Health Center, Lau district, Maros regency in 2021.

Method: Research type analytic observational with case control design. The data analysis technique uses the chi-square statistical test.

Result: Typhoid Fever mostly found in the age 11-19 years as many as 21 people (*P-value* 0.049), gender obtained that the most in men as many as 22 people (*P-value* 0.014), level primary school education is obtained as many as 14 people (*P-value* 0.07), habit washes hand before eat less good obtained as many as 17 people (*P-value* 0.044), habit washes hand after a less CHAPTER good obtained as many as 19 people (*P-value* 0.013), habit eat / snack outside house obtained as many as 23 people (*P-value* 0.026), habit wash ingredients food less raw good obtained as many as 18 people (*P-value* 0.046) and sanitation, less environment, good obtained as many as 25 people *P-value* 0.041) .

Conclusion: Based on results, study concluded that on the variable age, gender, education, habits wash hand before eats, habit washes hand after defecation, habit eats / snack outside home, custom wash ingredients food raw and sanitary environment own connection with factor risk incident fever typhoid in the health center Lau districts Maros in 2021.

Keywords: Typhoid fever; habit; salmonella typhi

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Introduction

Typhoid fever is a disease caused by Salmonella bacteria typhi or Salmonella typhosa of the genus Salmonella. Fever Typhoid very tight relation with hygiene or cleanliness. Bacteria Salmonella typhi like life in dirty food or land, so that if someone eats dirty food and during power stand her body low, so Salmonella bacteria typhi will attack the person's intestines

According to WHO (World Health Organization), estimates the worldwide incidence rate is between 1.6 and 33 million, with 500.000 – 600.000 deaths each year. Based on the report received from the South Sulawesi Province Disease Control and Environmental Health Office in 2016, it was obtained incident typhoid fever as many as 5,404 case. There are many possible factors causing incident fever typhoid as factor age, gender, sanitation environment, work, education, personal hygiene as well the place stay sufferer. Based on results research conducted by Abrian et al (2021), shows there is a connection between personal hygiene and sanitation environment with incident of fever typhoid

Then based on results research conducted Maghfiroh (2016) and Batubuaya (2017) mention that that be factor risk fever typhoid among them practice wash hand before eat, practice wash hand after defecation, condition the place disposal waste, processing food , habits eat out home , job respondents , and level income head family .

Method

This research used study quantitative observational with approach cross sectional because study this conducted by method collect dependent and independent data in one same time knowing the risk factors of fever disease of typhoid in patients Lau Health Center in 2021.

Result

Univariate analysis

Age

Table. 1 Typhoid Fever Analysis Based on Age

Age	Frequency (n)	(%)
Teenagers 11-19 years	41	62,1%
Adults 20-60 years	25	37,9%
Total	**66**	**100%**

Based on table 4.1 , the frequency of Typhoid Fever patients based on age, were 41 adolescent patients 11-19 years more (62.1 %) and adult patients 20-60 years, 25 patients (37.9 %) .

Gender

Table. 2 Analysis of Typhoid Fever Based on Gender

Gender	Frequency (n)	(%)
Male	34	51,5%
Female	32	48,5%
Total	**66**	**100%**

Based on table 4.2 , the results of patient frequency based on gender were obtained, where there were 34 male patients (51.5 %) and 32 female patients (48.5 %) .

Education Level

Table. 3 Analysis of Typhoid Fever Based on Education Level

Education Level	Frequency (n)	(%)
Elementary school	26	39,4%
Junior high school	20	30,3%
Senior high school	10	15,2%
college	10	15,2%
Total	**66**	**100%**

Based on table 4.3 , the respondents were obtained based on Education level, where there were 26 elementary school patients (39.4%), 20 junior high school patients (30.3%), 10 high school patients (15.2%), and 10 college patients (15.2 %).

The habit of washing hands before eating

Table. 4 Analysis of Typhoid Fever Based on the Habit of Washing Hands before Eating

Hand washing before eating	Frequency (n)	(%)
Less good	26	39,4%
Good	40	60,6%
Total	**66**	**100%**

Based on table 4.4, the patient frequency results were obtained based on the habit of washing hands before eating, where patients were not good at washing hands as many as 26 patients (39.4 %) and patients were good at washing hands as many as 40 patients (60.6 %).

Habit of washing hands after defecating

Table. 5 Analysis of Typhoid Fever Based on Washing Habits Hands after defecate

Hand washing After defecate	Frequency (n)	(%)
Less good	28	42,4%
Good	38	57,6%
Total	**66**	**100%**

Based on table 4.5, the results of patient frequency based on the Habit of Washing Hands after defecating, where 28 patients (42.4 %) were not good at washing hands and 38 patients (57.6 %) were good at washing hands.

Habits Eating/Snacking

Table.6 Analysis of Typhoid Fever Based on the Habits of Eating / Snacking Outside the Home

Habits of snacking outside	Frequency (n)	(%)
Often	37	56,1%
Rarely	29	43,9%
Total	**66**	**100%**

Based on table 4.6 , the patient frequency results were obtained based on the habit of snacking outside, where patients who often snacked were 37 patients (56.1%) and did not snack frequently as many as 29 patients (43.9%)

Washing Habits Food raw

Table. 7 Analysis of Typhoid Fever Based on Material Washing Habits Food Raw

Habits of washing food material	Frequency (n)	(%)
often	28	42,4%
rarely	38	57,6%
Total	**66**	**100%**

Based on table 4.7 , the results of the frequency of Typhoid Fever patients based on the Habit of Washing Foodstuffs where patients who often wash food are 28 patients (4–2.4%) and do not wash frequently as many as 38 patients (5–7.6%)

Environmental Sanitation

Table. 8 Analysis of Typhoid Fever Based on Environmental Sanitation

Variable	Frequency (n)	(%)
Low	**42**	**63,6%**
High	**24**	**36,4%**
Total	**66**	**100%**

Based on table 4.8 , the patient frequency results are obtained based on Environmental Sanitation. Where based on clean water sanitation that is good as many as 24 patients (36.4%) and not good as many as 42 patients (63.6%).

Analysis Bivariate
Age

Table. 9 Relationship Age to Typhoid Fever Incidence

Age (Years)	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
11- 19	2 1 31.8%	20 30.3%	41 62.1 %	0.049	2,692
20 - 60	1 2 18.2 %	13 19.7 %	25 37.9 %		
Total	33 50%	33 50%	66 100%		

Based on Table. 9 is obtained data result that is the connection age between fever typhoid. Patient with aged 11-19 years who experienced fever typhoid as many as 21 people (31.8%) and those who don't experience fever typhoid as many as 20 people (30.3%). Whereas for patient with aged 20-60 years who experience fever typhoid as many as 12 people (19.7%) and those who do not experience fever typhoid as many as 13 people (18.2%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.049 (*P-value* <0.05). Then got concluded that there is significant relationship among age to fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 2.692. This signify ages 11-19 years potentially causing somebody experience fever typhoid of 2.692 times compared with those aged 20-60 years.

Gender

Table. 10 Gender Relations to Typhoid Fever Incidence

Gender	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
Man	22 33.3%	12 18.2%	34 51.5%	0.014	3,500
Woman	11 16.7%	21 31,8%	32 48,5%		
Total	33 50%	33 50%	66 100%		

Based on table 4.10 obtained the result of the data, the connection gender between fever typhoid . Patient

experienced man fever typhoid as many as 22 people (33.3%) and those who do not experience fever typhoid as many as 12 people (18.2%). Whereas for patient experienced women fever typhoid as many as 11 people (16.7%) and those who did not experience fever typhoid as many as 21 people (31.8%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.014 (*P-value* <0.05). Then got concluded that there is significant relationship among type sex to fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 3,500. This signify man potentially causing somebody experience fever typhoid by 3.5 times compared with girl.

Level of education

Table. 11 Relationship between Education Level and Typhoid Fever Incidence

Education	Typhoid Fever		Total	P- Value
	Yes	Not		
Elementary school	14 21.2%	12 4.5%	26 39.4 %	0.007
Junior high school	10 15.2%	10 15.2%	20 30.3%	
Senior high school	7 1 0.6 %	3 4.5 %	10 15.2 %	
College	2 3.0%	8 12.1%	10 15.2%	
Total	**33 50%**	**33 50%**	**66 100%**	

Based on table. 11 the result of the data found the connection between education and fever typhoid. Patient with experienced primary school education fever typhoid as many as 14 people (21.2%) and those who don't experience fever typhoid as many as 12 people (18.2%). For patient with experienced junior high school education fever typhoid as many as 10 people (15.2%) and those who don't experience fever typhoid as many as 10 people (15.2%). For patient with experienced high school education fever typhoid as many as 7 people (10.6%) and those who do not experience fever typhoid as many as 3 people (4.5%). Whereas for patient with education experienced universities fever typhoid as many as 2 people (3.0%) and those who do not experience fever typhoid as many as 8 people (12.1%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.07 (*P-value* <0.05). Then got concluded that there is significant relationship among education to fever typhoid.

Washing Hands before Eating

Table. 12 Habit Relationship Wash Hands before Eating to Typhoid Fever Incidence

Wash Hands Before Eating	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
Not good	17 25.8%	9 13.6%	26 39.4%	0.044	2,883

Well	16 24.2%	24 36.4%	40 60.6%
Total	33 50%	33 50%	66 100%

Based on table 4.12 the result of the data found the connection between wash hand before eat and fever typhoid. The patient that has the less habit for washing hand has fever typhoid 17 people (25.8%) and those who do not experience fever typhoid as many as 9 people (13.6%). Whereas for the patient that good habits in wash hand before eating has fever typhoid 16 people (24.2%) and those who do not experience fever typhoid as many as 24 people (36.4%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.044 (*P-value* <0.05). Then got concluded that there is significant relationship among wash hand before eat to fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 2.883. This signifies wash hands before eat less good potentially causing somebody experience fever typhoid of 2.883 times compared with washing hand before eating.

Habit Washing Hands after Defecation

Table. 13 Relationship of Washing Habits Hands after defecate to Incident Typhoid Fever

Wash Hands After defecating	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
Not good	19 28.8%	9 13.6%	28 42.4%	0.013	3,619
Well	14 21.2%	24 36.4%	38 57.6%		
Total	33 50%	33 50%	66 100%		

Based on table 13, there is a connection between wash hand after defecating against fever typhoid. Less patient, good in wash hand after defecate experienced fever typhoid as many as 19 people (28.8%) and those who do not experience fever typhoid as many as 9 people (13.6%). Whereas for good patient wash hand after defecate experienced fever typhoid as many as 14 people (21.2%) and those who don't experience fever typhoid as many as 24 people (36.4%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.013 (*P-value* <0.05). Then got concluded that there is significant relationship among wash hand after defecate against fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 3.619. This signify wash hand after less defecate goods potentially causing somebody experience fever typhoid of 3.619 times compared with washing hand after defecate.

Habits of Snacking outside the House

Table. 14 Relationship between eating/ snacking habits outside the House against Incident Typhoid Fever

Eating or Snacking Habits	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
Not good	23 34.8%	14 21.2%	37 56.1%	0.026	3,121
Well	10 15.2%	19 28.8%	29 43.9%		
Total	33 50%	33 50%	66 100%		

Based on table. 14, the result of the data found the connection between habits of eating or snacking outside house to fever typhoid less patient good in habit eat or experienced snacks fever typhoid as many as 23 people (34.8%) and those who do not experience fever typhoid as many as 14 people (21.2%). Whereas for good patient habit eat or experienced snacks fever typhoid as many as 10 people (15.2%) and those who don't experience fever typhoid as many as 19 people (28.8%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.026 (*P-value* <0.05). Then got concluded that there is significant relationship among habit eat or snacking to fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 3.121. This signify habit eat or less snacks good potentially causing somebody experience fever typhoid of 3.121 times compared with habit eat or snacking.

Washing Foodstuffs Raw

Table. 15 Relationship of Washing Food stuffs Raw to Incident Typhoid Fever

Washing Raw Food	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
Not good	18 27.3%	10 15.2%	28 42.4%	0.046	2,760
Well	15 22.7%	23 34.8%	38 57.6%		
Total	33 50%	33 50%	66 100%		

Based on table. 15 the result of the data found the connection between wash food raw to fever typhoid. less patient good in wash food experienced raw fever typhoid as many as 18 people (27.3%) and those who do not experience fever typhoid as many as 10 people (15.2%). Whereas for good patient wash food experienced raw fever typhoid as many as 15 people (22.7%) and those who don't experience fever typhoid as many as 23 people (34.8%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.046 (*P-value* <0.05). Then got concluded that there is significant relationship among wash food raw to fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 2,760. This signify wash food less raw good potentially causing somebody experience fever typhoid by 2,760 times compared with wash food raw.

Sanitation Environment

Table. 16 Sanitation Relations Environment to Typhoid Fever Incidence

Environment sanitation	Typhoid Fever		Total	P- Value	*Odds Ratio*
	Yes	Not			
Low	25 37.9%	17 25.8%	42 63.6%	0.041	2,941
High	8 12,1%	16 24,2%	24 36,4%		
Total	33 50%	33 50%	66 100%		

Based on table.16 the result of the data found the connection between sanitation environment to fever typhoid less patient good in sanitation experiencing environment fever typhoid as many as 25 people (37.9%) and those who do not experience fever typhoid as many as 17 people (25.8%). Whereas for good patient sanitation experiencing environment fever typhoid as many as 8 people (12.1%) and those who do not experience fever typhoid as many as 16 people (24.2%). Based on the statistical test Chi-Square with SPSS is obtained score *P-values* of 0.041 (*P-value* <0.05). Then got concluded that there is significant relationship among sanitation environment to fever typhoid.

Based on table above is also obtained score *Odds Ratio* of 2.941. This signify sanitation low environment potentially causing somebody experience fever typhoid of 2.941 times compared with sanitation high environment.

Discussion

This research was conducted during the period October - December 2022 at the Lau Public Health Center, Lau District, Maros Regency. And get a sample of 66 samples. From the sample, the following discussion was obtained:

Age Relations to Typhoid Fever Incidence.

The data obtained were Typhoid Fever patients based on age, where there were 21 adolescent patients 11-19 years old (31.8 %) and 12 adult patients 20-60 years old (18.2 %). Based on the Statistical Square Chi-Test with SPSS, p = 0.049 (*P-value* <0.05) . So it can be concluded that there is a relationship between age and the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency. This research conducted on fever patients typhoid children and youth who treated in Home Sick Pertamina Star Amen city Lampung Year 2018 based on age highest exist at age teenager [(36)] .

Typhoid fever could happens to all age , At Age children 5-11 years is age school where in the group age the often do outside activity _ house , so that risky infected Salomonella typhi like snacking at school or outside house which not enough guaranteed cleanliness (consume food and drink which contaminated). There are factors hygiene, power stand body and milk contamination or product milk by carrier could causing

children more many contaminatedSalmonella typhi [36]

Gender Relations against Typhoid Fever Incidence

The results obtained were 22 male patients (33.3 %) and 11 female patients (16.7 %). Based on the Statistical Square Chi-Test with SPSS, the value of p = 0.0 14 (*P - value* < 0.05). So, it can be concluded that there is a relationship between gender and the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency.

This research conducted by Maria in 2012, namely that men have more activities outside the home than women. More men consume ready-to-eat food or food stalls which usually contain a lot of flavoring and hygiene that is not guaranteed, compared to women who prefer to cook their own food so they pay more attention to the composition and cleanliness of the food. This habit makes men more susceptible to food-borne diseases such as typhoid if the food purchased is not hygienic. Based on this discussion, from a dietary perspective, men are more susceptible to disease than women. [40]

Educational Level Relationship to Typhoid Fever Incidence

The data obtained were typhoid fever patients based on education level, where elementary school patients were 14 patients (21.2 %), Junior high school patients were 10 patients (15.2%), high school patients were 7 patients (10.6 %), and D3 /Higher Education in 2 patients (3.0%). Based on the Square Statistical Chi-Test with SPSS, p value = 0.07 (*P - value* < 0.05). So, it can be concluded that there is a relationship between the level of education and the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency.

This is in line with firmawati's research (2021) that Education level matters to incident fever typhoid where Education level SD, SMP categorized low [41]. Low level of knowledge could cause somebody no understand how guard hygiene and storage food so that could increase risk happening disease typhoid fever. 21

The Relationship between the Habits of Washing Hands before Eating To Incident Typhoid Fever.

The results obtained were 17 patients (25.8%) who did not wash their hands well and 16 patients (24.2%) were good at washing their hands . Based on the Square Statistical Chi-Test with SPSS, p = 0. 0 44 (*P-value* < 0.05) . So it can be concluded that there is a relationship between the habit of washing hands before eating with the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency.

This research conducted by Malau in 2015, tittle the relationship between the habit of washing hands before eating and the incidence of typhoid fever in the working area of the Bandarharjo Health Center in Semarang City, the results obtained were p = 0.042 with OR = 2.870 and CI = 1.135-7.252. The results of

another similar study by Pramitasari (2013) regarding the risk factors for typhoid fever at Ungaran Hospital concluded that the habit of not washing hands before eating and washing hands without using soap is a risk factor for typhoid fever [(37)] .

Also supported by research conducted by Prasad (2018) also states that dirty hands can transfer pathogenic bacteria from hands to food, so that the bacteria that enter can infect a person's body, so washing hands frequently after defecating and before eating using soap can reduce risk of typhoid fever . The results of this study can illustrate that the circumstances of cases and controls have quite clear differences, where in the group of cases who have a bad habit of washing their hands before eating more than those who have good habits . This shows that the habit of washing hands before eating has a significant effect on the incidence of typhoid fever , so self-awareness is needed to get used to washing hands with running water soap to prevent transmission of Salmonella . typhi onto food from dirty hands [(38)] .

The Relationship between Hand Washing Habits After defecate to Incident Typhoid Fever

The results of the data were that 19 patients (28.8%) patients did not wash their hands well and 14 patients (21.2 %) were good at washing hands. Based on the Square Statistical Chi-Test with SPSS, p = 0. 0 13 (*P-value* < 0.05) . So it can be concluded that there is a relationship between the habit of washing hands after defecating with the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency

Research this aligned with study Maghfiroh, Arum Siwiendrayanti (2016) obtained results there is connection among habit wash hand after defecate with incidence of Typhoid Fever. Dirty hands or contaminated could move bacteria or viral pathogens from body, faces or other sources to food. Therefore, cleanliness hand with wash hand need get priority high, though Thing the often underestimated washing with soap as cleaning, scrubbing and rinsing with running water will wash away particle lots of dirt contain micro organization. [(28)]

The Relationship of Eating / Snacking Out to Typhoid Fever Incidence

The results of the data are that the patient often eats outside 23 patients (34.8%) and 10 patients (15.2%) infrequent *snacks.* < 0.05). So, it can be concluded that there is a relationship between snacking outside and the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency.

This is in line with the research conducted by Nada Khairunnisa in 2020, namely the relationship between snacking habits with incident fever typhoid in children age school is taken care of stay HOSPITAL petala earth Riau province in 2020, the results obtained were p = 0.0 26 with OR = 5.571 [(45)] . The results of other studies are similar namely by Volard (2013) that the habit of snacking or eating outside the provision of the home is a risk factor for the incidence of typhoid fever in inpatients at Ungaran Hospital. The behavior of food handlers influences food contamination. A food handler is encouraged to adopt healthy

behaviors related to food handling, including washing hands before handling or processing food. food obtained from roadside food vendors is significantly associated with the transmission of typhoid fever (OR=3.34) and also in another study found that street food or beverage vendors or itinerants more often did not wash their hands before preparing food, had direct contact with food and less educated than restaurants and stalls [(42)]

Relationship of Washing Raw Foods to Incident Typhoid Fever

The results of the data obtained were that there were 15 patients (22.7 %) who often washed food and did not wash frequently food as many as 18 patients (27.3 %)). Based on the Statistical Square Chi-Test with SPSS, p value = 0.04 6 (*P-value* <0.05). So it can be concluded that there is a relationship between Handwashing Habits and the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency.

Syapila's research in 2018 that found Salmonella contamination sp in vegetables can come from irrigation water contaminated with sewage, soil, or animal manure used as fertilizer. In addition, vegetables that grow around wastewater disposal can also be contaminated with Salmonella bacteria sp. In this study most of the respondents had washed the vegetables to be consumed using running water. Consuming raw vegetables will not be a problem if consumed in the right way, namely by washing thoroughly before consumption to remove dirt, chemicals such as pesticides, and Salmonella bacteria. typy. So that it can reduce the transmission of typhoid fever through raw food [(39)] .

Environmental Sanitation Relations to Incident Typhoid Fever

The obtained data result based on clean water sanitation that is good as many as 8 patients (12.1 %) and not good as many as 25 patients (37.9%). Based on the Statistical Square Chi-Test with SPSS, p value = 0.04 1 (*P-value* <0.05) . So it can be concluded that there is a relationship between Environmental Sanitation and the incidence of Typhoid Fever at the Lau Health Center, Lau District, Maros Regency.

This is in line with opinion Widoyono in 2011 that clean water facilities is one _ means sanitation that is not lost importance related with incident fever typhoid . Principle transmission fever typhoid is through faecal -oral, germs originate from feces or urine sufferer or even carrier (carrier disease that is not sick) who entered to in body through water and food. Use of polluted drinking water germs in a manner bulk often responsible answer to happening Extraordinary Events (KLB) [(43)].

research conducted by Namrata Prasad in 2018 own facility sanitation that is not repaired or damaged (OR = 4.30; 95% CI 1.14-16.21) in a manner significant associated with fever typhoid as well as in line with research by Nurvina Wahyu Artanti (2012), which shows that clean water facilities with incident fever typhoid obtained from p value = 0.004 (<0.05) and OR of 2.215 which means that respondents who have

clean water facilities no fulfil condition have risk for affected by Typhoid Fever 2.215 times more big from the respondent have clean water facilities fulfil terms [(44)] .

Conclusion

Based on results, study concluded that on the variable age, gender, education, habits wash hand before eats, habit washes hand after defecation, habit eats / snack outside home, custom wash ingredients food raw and sanitary environment own connection with factor risk incident fever typhoid in the health center Lau districts Maros in 2021.

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ORIGINAL ARTICLE Open Access

Disease Characteristic of Obese Patients with Seek Treatment at RSUD Dr. H. Chasan Boesoirie Ternate

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ABSTRACT

Introduction: Obesity is the accumulation of excess fat due to an imbalance in energy intake with the energy used by the body. Obesity can be differentiated based on the distribution of fat into 2, namely central obesity, which is also called "apple shape obesity" or "android obesity", which is more often found in men, and peripheral obesity which is also called "gynecoid obesity" or "peer shape obesity", which is more often found in women. Some of the risk factors for obesity such as genetics, socioeconomic status, environment, and psychology.
Method: This study aims to determine the characteristics of obese patients who seek treatment at RSUD Dr. H. Chasan Boesoirie Ternate in 2019. This study used a descriptive design with a cross-sectional method with a total sample was 95 medical record data for obese patients. This study used secondary data from medical records of obese patients at RSUD Dr. H. Chasan Boesoirie Ternate in 2019.
Result: Characteristics of diseases in obese patients at RSUD Dr. H. Chasan Boesoirie Ternate in 2019 were found to be 20-60 years 75 people (80%), women 69 people (72.6%), work as housewives 54 people (56.8%), the level of high school education was 36 people (37.9%), obesity I 68 people (71.6%), and the type of type 2 diabetes mellitus 46 people (48.4%).
Conclusion The highest distribution of obese people was found the most in female, the age group of 20-60 years, and the most comorbidity in diabetes mellitus.

Keywords: Characteristics; diabetes mellitus; obesity

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Introduction

Obesity is a state of imbalance between incoming energy and outgoing energy over a long period of time. The amount of energy intake from digested food exceeds the energy used for metabolism and daily activities. This excess energy will be stored in the form of fat and adipose tissue so that it can result in weight gain.[1]

In the last three decades, the worldwide prevalence of obesity has increased by 27.5% for adults and 47.1% for children. The number of adults aged > 18 years who are obese is 650 million out of a total of > 1.9 billion adults who were overweight in 2016. Around 13% of the world's adult population, including 11% of men and 15% of women, were obese in 2016. Based on data from the 2018 Riskedas, the incidence of obesity in Indonesia has a prevalence of obesity in adults ≥ 18 years of 21.8%. The highest percentage of obesity was in the province of North Sulawesi at 30.2%, and the lowest was in East Nusa Tenggara at 10.3%.[2,3,4]

The results of various studies reveal that the morbidity rate in obese people is higher than in people with normal weight, which means that obese people are more likely to get sick than people with normal weight. Likewise, the death rate (mortality) in obese people is higher when compared to the death rate in people with normal weight. Research conducted by Kinlen (2018) shows that obesity is associated with increased mortality and various complications such as diabetes, heart disease, dementia, and cancer. Even low levels of overweight are associated with an increased risk, and weight loss remains the best way to manage complications. In another research by Dali(2017)the most common morbidity effect of obesity in the case group (obesity) is hypertension, which is 51.7%.[5,6]

Method

This research is a descriptive study with a cross-sectional method using secondary data in the form of medical records taken from RSUD Dr. H. Chasan Boesoirie Ternate. This research was conducted in May - June 2022. The population of this study was obese patients at Dr. H. Chasan Boesoirie Ternate 2019.

The research sample was taken in total samplingand all populations that met the criteria were used as samples. Based on how to obtain data, the data collected is secondary data. Secondary data was obtained by looking at the patient's medical record results. Data processing is carried out electronically using the Statistical Product and Service Solution (SPSS) application and is described in tabular form.

Result

This research was conducted by collecting secondary data from the medical records of obese patients who sought treatment at RSUD Dr. H. Chasan Boesoirie Ternate in 2019. The sample that met the inclusion

criteria obtained 95 medical record data from the research conducted.

Characteristics of obese people by age

Table 1. Characteristics of obese people by age group

Age	Frequency	%
20-60	76	80%
>60	19	20%
Total	95	100%

Based on the table above, it is known that most incidents occurred in the age group of 20-60 years, with a total of 76 cases or 80%, while in the age group >60 years, namely 19 people or 20%.

Characteristics of obese people by gender

Table 2. Characteristics of obese people according to gender

Gender	Frequency	%
Male	26	27,4%
Female	69	72,6%
Total	95	100%

Based on the distribution of obese people according to gender, the most incidents were in female, with 69 cases or 72.6%, followed by male with 26 cases or 27.4%.

Characteristics of obese people based on work

Table 3. Characteristics of obese people work

Work	Frequency	%
Housewife	54	56,8%
Private employee	4	4,2%
Civil servant	20	21,1%
Farmer	2	2,1%
BUMN employee	1	1,1%
Self-employed	9	9,5%
Laborer	1	1,1%
Unemployed	4	4,2%
Total	95	100%

Based on the distribution of obese people by type of work, it was found that the highest number of incidents occurred in patients who worked as housewives, with a total of 54 people or 56.8%, and the least number of cases were found in laborer and BUMN employee with each 1 person or 1.1%.

Characteristics of obese people based on education background

Table 4. Characteristics of obese people according to education

Education background	Frequency	%
Elementary school	25	26,3%
Junior High School	7	7,4%
Senior High School	36	37,9%
Bachelor	23	24,2%
D1/D2/D3	1	1,1%
Unexplained	3	3,2%
Total	95	100%

Based on the distribution of obese people based on education, it was found that the most incidents occurred at the high school education level, with a total of 36 people or 37.9%, and the least incidents were found at the D1/D2/D3 level with 1 person or 1.1%.

Characteristics of obese people based on body mass index

Table 5. Characteristics of obese people according to body mass index

BMI	Frequency	%
Obese I (25 – 29,9)	68	71,6%
Obese II (≥ 30)	27	28,4%
Total	95	100%

Based on the distribution of obese people according to Body Mass Index (BMI), the most obese patients were found in the Obesity I group (25-29.9) with a total of 68 people or 71.6%, followed by obesity II (≥30) with 27 people or by 28.4%.

Characteristics of obese people based on comorbidities

Table 6. Characteristics of obese people according to comorbidities

Type of disease	Frequency	%
Type 2 DM	46	48,4%
Grade 1 hypertension	15	15,8%
CHD	11	11,6%
Cholelithiasis	5	5,3%

Colorectal Cancer	2	2,1%
Osteoarthritis Genu	4	4,2%
Breast cancer	11	11,6%
Hemorrhagic Stroke	1	1,1%
Total	95	100%

Based on the distribution of obese people according to comorbidities, it is known that the highest incidence occurred in type 2 diabetes mellitus with a total of 46 people or as much as 48.4%, and the least was found in stroke, namely 1 person or 1.1%.

Discussion

Age

Based on the age group, the most incidents occurred in the 20-60 year age group with a total of 76 cases or 80%, while in the >60 year age group, there were 19 people or 20%. This research is in line with research conducted by Armanto et al. (2021), who assessed the characteristics of obesity based on age vulnerability in the Nganganaumala sub-district, Bau-Bau city, found that the highest incidence was in the age group 20-60 years of 89.8%. Vulnerable age affects the incidence of obesity; the older you are, the greater the risk of obesity. Obesity in adulthood impacts health, where weight gain and obesity are risk factors for increasing the incidence of non-communicable diseases.[7]

Obesity tends to increase with age and reaches its peak in adulthood. As we get older, the body's metabolic processes will tend to decrease, which will cause muscle function to decrease and body fat levels to increase. Suppose it is not balanced with a healthy lifestyle, such as regulating diet and physical activity. In that case, there will be an accumulation of body fat which will increase the risk of obesity.[8,9]

Gender

Based on the distribution of obese people according to gender, the most incidents were in women with 69 people or 72.6%, followed by men with 26 cases or 27.4%. This study's results align with research conducted by Arifani et al. (2021), which assessed risk behavior factors associated with the incidence of obesity in adulthood in Banten province in 2018 and found that most of the research subjects were women, namely 53%. Alamsyah et al. (2019) research on the determinants of the incidence of obesity in adults in the working area of the Simpang Tiga Public Health Center in Pekanbaru City is also in line with this study, where the proportion of respondents with female gender obesity was 53.5%.[10,11]

Research by Hassan et al. (2022) regarding the prevalence of obesity and overweight in adults in Middle Eastern countries over the past two decades found that obesity was higher in women than men. Women tend to have lower physical activity than men. Increasing age in women will cause a loss of muscle mass by as much as 30-50%. If this is not balanced with sufficient physical activity, it can cause the body's ability to process food to decrease and result in fat accumulation.[10,12]

Type of work

Based on the distribution of obese people by type of work, it was found that the most incidents occurred in patients who worked as housewives (IRT), namely 54 people or 56.8%, and the least was found in laborers and BUMN workers, namely 1 person or by 1.1%. This study's results align with research conducted by Septiyani et al. (2020) regarding obesity and central obesity in adults in urban areas in Indonesia, with housewives (IRT) as the highest percentage, namely 37.4%. Another study conducted by Sundari et al. (2015) is also in line with the results of this study, where the highest incidence of obesity was among respondents who worked as housewives, namely 77.3%.[13,14]

Based on occupation, the prevalence of obesity is higher among those who work as housewives. Factors that influence the incidence of obesity among housewives include low physical activity. Another factor that affects housewife obesity is energy intake which is more significant than energy expenditure in the long term. Jobs with low physical activity will be an opportunity for fat accumulation in the body. Jobs with low activity, such as teachers, traders, housewives, and retirees generally have more sedentary activities. In contrast jobs such as farmers, ranchers, employees, and entrepreneurs who have high activity will expend more energy. In addition, in several studies the use of hormonal contraception (injections, pills, and implants) in housewives causes weight gain, this is caused by an increase in the hormones estrogen and progestin in the body which cause fluid retention and increase appetite to increase body weight.[15,16]

Education Background

Based on the distribution of obese people based on education, it was found that the most incidents occurred at the high school level with a total of 36 people or 37.9%, and minor incidents were found at the D1/D2/D3 level with a total of 1 or 1.1%. The results of this study are in line with research conducted by Sumael et al. (2020) concerning the relationship between physical activity and the incidence of obesity at the Pangolombian health center, where it was found that most of the respondents had the last high school education (SMA), namely 55.3%.[17]

Education influences knowledge of nutrition. The higher a person's education, the more nutritional knowledge he has. Knowledge of good nutrition also causes a person to have good eating habits, so the possibility of consuming unhealthy foods decreases. The lower the education, the higher the risk of obesity. The level of education affects food consumption through the selection of food ingredients. People with higher levels of education tend to choose foods that are good for their bodies compared to people with lower levels

of education. Someone with a low level of knowledge will often choose whole food without understanding the balanced nutritional intake needed by the body. So, too many carbohydrates are consumed in one serving of food. Someone with good knowledge about obesity still engages in unhealthy behaviors such as a sedentary lifestyle and excessive eating when experiencing stress. Knowledge is part of behavior, but this does not guarantee that people with good knowledge also have good behavior. Because a person's behavior is also influenced by other factors.[5,18]

Body Mass Index

Based on the distribution of obese people according to body mass index (BMI), the most obese patients were found in the Obesity I group (25-29.9) with a total of 68 people or 71.6%, followed by obesity II (≥30) with 27 people or by 28.4%. This research is in line with research conducted by Masi et al. (2018) regarding the relationship between obesity and the incidence of diabetes mellitus in the working area of the Ranomut Public Health Center in Manado City, where the most common distribution was Obesity I, which was 37.3%. Obesity can occur due to an imbalance between the energy from food that enters greater than the energy used by the body.[13,19]

Comorbidities

Based on the distribution of obese people according to comorbidities, it is known that the highest incidence occurred in type 2 diabetes mellitus with a total of 46 or as much as 48.4%, and the minor incidence was found in stroke, namely 1 or 1.1%. This study is in line with research conducted by Masi et al. (2018) concerning the relationship between obesity and the incidence of diabetes mellitus in the working area of the Ranomut Public Health Center in Manado City was found that 57.6% of respondents had diabetes mellitus. In a study conducted by Lisna et al. in 2018, which discussed the relationship between obesity and the incidence of type 2 diabetes mellitus in women of childbearing age in the working area of the Pintupadang Health Center, said that there was a relationship between obesity and the incidence of type 2 diabetes.[19,20]

Obesity causes chronic, low-grade inflammation involved in type 2 diabetes mellitus. Obesity is associated with a chronic, low-grade inflammatory condition with progressive infiltration of immune cells in obese adipose tissue. Cytokines released by immune cells and adipose tissue adipokines increase tissue inflammation and induce insulin resistance.[21]

The mechanism responsible for the high state of oxidative stress in obesity is unknown, but what is clear is that adipose tissue is an essential mediator of oxidative and inflammatory stress because it contributes to the production of free radicals and proinflammatory cytokines, including IL-6 and TNF-α. Inflammation as a manifestation of increased oxidative stress, which increases in someone with obesity. The mechanism of inflammation in obesity is related to the presence of adipose tissue, which produces hypoxia-induced adipokines and acute-phase proteins. Hypoxia will be generated during the overgrowth of adipose tissue during obesity. Adipose tissue produces 25% of systemic IL-6, so that this adipose tissue can cause low-

grade systemic inflammation in people with excess body fat. [22]

Conclusions

Based on research conducted at RSUD Dr. H. Chasan Boesoirie Ternate regarding the disease characteristics of obese people. In 2019, the highest distribution of obese people was found in the age group of 20-60 years with 75 people (80%), female gender with 69 people (72.6%), work as housewives 54 people (56.8%), high school education level 36 people (37.9%), obesity body mass index I 68 people (71.6%), and diabetes mellitus type 2 comorbidities 46 people (48.4%). As for the suggestions from this study for future researchers, it is hoped that further research will be carried out by taking more samples so that they can describe more of the characteristics of the variables studied. H. Chasan Boesoirie Ternate to further improve the quality of service in terms of preventing obesity such as making leaflets as a means of educating patients about what factors influence the incidence of obesity, for obese patients it is advisable to pay more attention to their conditions and get used to adopting a healthy lifestyle in everyday life and also control eating patterns and increase physical activity, it is hoped that the government can carry out socialization programs regarding the dangers of obesity and ways to prevent obesity.

Conflict of Interest

There is no conflict of interest

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