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RESEARCH ARTICLE

Relationship Between Simple Carbohydrate Intake and Increased Risk of Comorbidity in Urban Adults

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Introduction: Obesity is an escalating global health crisis, with the prevalence in Indonesia rising significantly from 15.4% in 2013 to 21.8% in 2018, according to Basic Health Research (Riskesdas) data. A severe consequence of this epidemic is the development of comorbidities, which are heavily driven by central obesity and can be quantified using Body Mass Index (BMI) and waist circumference measurements. Diets dense in simple carbohydrates, characterized by their high glycemic index, are a primary catalyst for visceral fat accumulation, thereby exacerbating the risk of metabolic complications. **Objective:** This study investigates the association between the frequency of simple carbohydrate intake and the elevated risk of comorbidities among urban adult populations. **Method:** A descriptive-analytical methodology was employed utilizing a cross-sectional study design. **Results:** Chi-square statistical analysis revealed a significant positive correlation, demonstrating that a higher frequency of simple carbohydrate consumption is directly associated with an increased risk of comorbidities ($p < 0.01$). **Conclusion:** There is a statistically significant association between high intakes of simple carbohydrates and a heightened risk of developing comorbidities in urban adults.

Keywords: Obesity, BMI, Waist circumference, Simple carbohydrates, Comorbidity risk

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INTRODUCTION

Obesity is a problem in many parts of the world where its prevalence is increasing rapidly, both in developed and developing countries. The results of Basic Health Research (Riskesdas) in 2013 found that the prevalence of the Indonesian population experiencing obesity was 15.4%. There was an increase of 14.8% within 5 years where in 2018 the Indonesian population was obese as much as 21.8%.[1.2]

The risk of comorbidities is closely related to central obesity which can be done with BMI and waist/abdominal circumference measurements. Obesity is also defined as the state of a person's body exceeding normal body weight resulting in the accumulation of excess body fat tissue.[3] Obesity is caused by less energy expended by the body compared to the amount of food that comes in. There are several complications of obesity, one of which is the occurrence of chronic diseases such as coronary heart disease, hypertension, diabetes, and cancer which ultimately results in death.[4] The risk of comorbidities in obesity can increase due to the accumulation of fat in several areas of the body, especially in the abdomen (visceral fat).[5.6]

Carbohydrates are one of the nutrients needed by humans that function to produce energy for the human body.[7] Simple carbohydrates consist of monosaccharides which are the basic molecules of carbohydrates, disaccharides formed from two monosaccharides that can be bonded together, and oligosaccharides which are short-chain sugars formed by galactose, glucose and fructose.[8] Simple carbohydrates have a high glycemic index so they are at greater risk of causing fat accumulation. Therefore, researchers wanted to know the relationship between simple carbohydrate intake and an increased risk of adult comorbidities in urban areas.[9.10]

RESEARCH METHODS

This descriptive-analytical study utilizing a cross-sectional design was conducted in Sei Mati, Medan City, North Sumatra, Indonesia, from March 2024 to April 2024.

Inclusion criteria for this research are: male and female aged 18-49; agreed to participate and signe the informed consent to fill the FFQ, the exclusion criteria for this research are: subject is in a strict diet; subject has comorbidity such as diabetes, etc; subject is pregnant.

This study was used as a descriptive analytical with a cross-sectional study design. The number of samples needed for this study was 90 samples. This research was carried out by measuring weight, height,

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waist circumference and distributing *a Food Frequency Questionnaire* (FFQ) where the questionnaire will be distributed to respondents to be corrected based on food intake that is often consumed.

RESULTS AND DISCUSSION

Research Results

This study was conducted in accordance with the approval of the Health Research Ethics Commission (KEPK) of the Faculty of Medicine, University of Muhammadiyah North Sumatra with number: 1176/KEPK/FKUMSU/2024.

Table 1 Distribution of Subject Characteristics Data

Characteristics	Value (n,%)	Median(Min-Max)
Gender		
Male	22 (24,4)	
Female	68 (75.6)	
Age (year):		29 (18 -53)
Height (cm):		160 (137-178)
Weight (kg):		78 (58-99)
Waist Circumference		
Male		
>90 cm	14 (63.6)	
<90 cm	8 (36.4)	
Female		
>80 cm	45 (44.1)	
<80 cm	23 (22.5)	
Simple Carbohydrate Consumption Frequency		
>3x/ week	72 (80)	
<3x/ week	18 (20)	
Status Gizi		
Underweight	14 (15.6)	
Normal	12 (13.3)	
Overweight	14 (15.6)	
Obese 1	35 (38.9)	
Obese 2	15 (16.9)	
Comorbidities in Obesity		
Average	14 (15.6)	
Increased	12 (13.3)	
Moderate	14 (15.6)	
Severe	35 (38.9)	
Very severe	16(16.7)	

The table above explains that the most gender is female with 75.6% of respondents compared to 24.4% of male respondents. The middle score is based on an average age of 29 years with a minimum age of 18 years and a maximum of 53 years. The average weight based on average weight is 78 kg with a minimum weight of 58 kg and a maximum of 99 kg. The middle value based on the average height is 160 cm with a minimum height of 137 cm and a maximum of 178 cm. Based on the most waist circumference, it is female >80cm with 44.1% of respondents. Based on the consumption of simple carbohydrates were >3x/week with 80% of respondents compared to <3x/week with 20% of respondents. Based on the BMI is obesity 1

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with 38.9% of respondents. Based on the increased risk of comorbidities, the most severe was severe with 38.9% of respondents and the lowest was increased with 13.3% of respondents.

Table 2 Relationship of Simple Carbohydrate Intake with Increased Risk of Adult Obesity Comorbidities in Urban Area

Consumption Frequency	>3x / week	<3x / week
Average n (%)	6 (8.3)	8 (44.4)
Increased n (%)	7 (9.7)	5 (27.8)
Moderate n (%)	12 (16.7)	2 (11.1)
Severe n (%)	34 (47.2)	1 (5.6)
Very Severe n (%)	16 (22.2)	2 (11.1)
Total n (%)	72 (100)	18 (100)
p-value	<0.01	

Based on the table of *chi square* statistical test results above, it can be obtained that the higher the frequency of consumption of simple carbohydrates, the higher the risk of comorbidities. Thus, a value with p <0.01 (p<0.05) indicates a relationship between simple carbohydrate intake and an increased risk of urban adult comorbidities.

Discussion

The study cohort exhibited a higher prevalence of obesity-related comorbidities among female participants (n=68, 75.6%) compared to male participants (n=22, 24.4%). In line with the 2014 study of Gbary et al in Benin, it showed that 10 (74) women were more obese than 3 (63) men.[11] Gender is one of the factors that is thought to influence the incidence of central obesity. Women are more likely to be central obesity than men due to differences in activity levels and energy intake. Women were found to do more light-moderate physical activity, while men tended to do strenuous activities.[12:13]

There is a distribution of frequencies based on age, the median value is obtained based on the average age of 29 years with a minimum age of 18 years and a maximum of 53 years in line with the results of the 2010 Riskesdas analysis, it is known that the nutritional status of adults in Indonesia, over 18 years is dominated by obesity problems and adult women (>18 years) in Indonesia have a higher prevalence of obesity (26.9) than men (16.3).[14.15] There is a frequency distribution based on waist circumference, it was found that from the research sample for male with a waist circumference of >90 cm, a total of 14 (63.6) samples were obtained,

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while a waist circumference of <90 cm was obtained with a total of 8 (36.4) samples.[16] Thus, female with a waist circumference of >80 cm was obtained with a total of 45 (44.1) samples, while for a waist circumference <80 cm, a total of 23 (22.5) samples were obtained.

This research is in line with research conducted by Ilmi and Utari (2020) on college students, the results of most patients who have a waist circumference of >80 cm in women and >90 cm in men are 33.3.[17,18] Waist circumference is an indicator to see the incidence of central obesity. It is categorized as central obesity if the waist circumference is >90 cm in men and >80 cm in women. The classification of waist circumference was adjusted to the criteria of the Asian population, namely subjects were categorized as centrally obese if they had a waist circumference of >80 cm for women and >90 cm for men, while subjects were not categorized as centrally obese if they had a waist circumference of ≤80 cm for women and ≤90 cm for men.[19,20] Consumption

Simple carbohydrates were dominated with a frequency of >3x/week with a total of 72 (80) samples. The consumption of simple carbohydrates, characterized by a high glycemic load, induces rapid postprandial hyperglycemia and subsequent hyperinsulinemia. Chronic exposure to this metabolic state drives hepatic lipogenesis and elevates serum triglyceride levels, promoting the expansion of visceral adipose tissue. This visceral adiposity acts as an active endocrine organ, precipitating the infiltration of macrophages and the systemic release of pro-inflammatory cytokines (such as TNF-α and IL-6). This inflammatory response disrupts metabolic homeostasis and directly exacerbates insulin resistance, forming the primary biological pathway that links high simple carbohydrate diets to the development and severity of metabolic syndrome and related comorbidities.[21,22,23]

In the frequency distribution based on nutritional status, it was found that from the research sample dominated by obese 1 with a total of 35 (38.9) samples, and there was a frequency distribution based on the frequency of consumption of simple carbohydrates, in this distribution it was dominated by a frequency of >3x/week with a total of 72 (80) samples. This is in line with research conducted by Nuzulvia (2013), showing that there is a significant relationship between nutritional status based on nutritional status and central obesity. Likewise, research conducted by Hasriana, et al. (2013), said that there is a meaningful relationship between a person's nutritional status and the incidence of central obesity.[24] This can be related to 2 factors, namely an increase in food intake and a decrease in

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energy expenditure.[25] In the distribution of frequencies based on comorbidities, it was found that from the most research samples with severe comorbidities , there were 35 (38.9) samples. The results of this study are in line with research conducted by Musdalifa and Wicaksono (2017) which shows that there is a relationship between body mass index and waist circumference, which will increase comorbidities.[26]

The risk of comorbidities with an increased severity in the future carries serious consequences for a person's health and quality of life. This condition can lead to an increased risk of death because the weakened organs of the body become more susceptible to failure, especially when complications occur. In addition, the overall quality of life will also decrease, as comorbidities often lead to physical limitations, chronic pain, and mental disorders such as depression or anxiety, all of which interfere with the ability to live daily life normally. The increased burden of medication and medical care required also adds to the financial and emotional pressure, both for the individual and his or her family, as they may require more frequent hospitalizations and more intensive medical care.

Comorbidities tend to exacerbate each other, for example, uncontrolled diabetes can worsen heart conditions, which can then accelerate the decline in overall health. In addition, the response to treatment can become slower or less effective due to interactions between medications or existing conditions, further complicating efforts to maintain health. In fact, treatments intended to treat one condition can worsen another, such as the use of corticosteroids that can raise blood sugar levels in people with diabetes. All of this suggests that comorbidities with an increasing degree of severity not only increase the risk of death.[27,28]

The results of *the chi square* statistical test showed p=<0.01 (p<0.05) which indicated a significant relationship between simple carbohydrate intake and an increased risk of urban adult comorbidities. According to Hasdianah (2014), factors that can affect the incidence of obesity are food consumption, genetics, environment, gender and physical activity. Food consumption can determine a person's nutritional status. The habit of eating improper and excessive food can trigger obesity. The theory states that high carbohydrate intake leads to obesity (Rathnayake, Roopasingam, & Dibley, 2014).[29,30] Research by Fereshteh, et al. (2019) conducted in Urmia, Iran showed that high carbohydrate intake has been associated with obesity risk.

The results of this study are in accordance with the results of the research of Muhammad Arttisto Adi Yussac, et al. who

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stated that there is a relationship between carbohydrate intake and obesity. The main role of carbohydrates in the body is to provide glucose for the body's cells, which are then converted into energy. Excess glucose will be stored in the liver in the form of glycogen. Muscle cells also store glucose in the form of glycogen. This glycogen is only used as energy for muscle needs and cannot be returned as glucose to the bloodstream. The body can only store a limited amount of glycogen, which is for energy purposes for a few hours. If carbohydrate intake exceeds the body's oxidative capacity and storage, cells can convert carbohydrates into fat. This change occurs in the heart. This fat is then carried to fat cells that can store an unlimited amount of fat.[31]

While this study demonstrates a significant association between simple carbohydrate intake and comorbidity risk, several limitations must be acknowledged. First, the cross-sectional design precludes the ability to establish definitive causality. Second, the analysis did not control for critical confounding variables that heavily influence metabolic health and obesity-related comorbidities, including total caloric intake, daily physical activity levels, socioeconomic status, sleep duration, and genetic predispositions. Future longitudinal studies incorporating multivariate analyses are required to isolate the specific impact of simple carbohydrates while adjusting for these lifestyle and environmental confounders

CONCLUSION

This study demonstrates a statistically significant positive association between high dietary intake of simple carbohydrates and an elevated risk of severe comorbidities in urban adults. Frequent consumption of high-glycemic diets directly contributes to visceral adiposity and the exacerbation of metabolic complications. These findings underscore the critical need for targeted public health interventions and nutritional education aimed at reducing refined carbohydrate consumption to mitigate the escalating burden of obesity-related metabolic syndromes in urban populations.

REFERENCES

1. Nartha KPPP. Penyakit Komorbid Sebagai Faktor Risiko Mortalitas Pasien Covid-19. Unram Med J. 2022;11(3):1079–84.
2. Angely C, Nugroho KPA, Agustina V. Gambaran Pola Asuh Anak Obesitas Usia 5–12 Tahun di SD Negeri 09 Rangkang, Kabupaten Bengkayang, Kalimantan Barat. J Sains dan Kesehat. 2021;3(6):816–25.
3. Kementerian Kesehatan RI. Riset Kesehatan Dasar (RISKESDAS) 2013. Lap Nas 2013 [Internet]. 2013.

E-ISSN :2722-0877

Available from: http://www.dof.gov.my/en/c/document_library/get_file?uuid=e25cce1e-4767-4acd-afdf-67cb926cf3c5&groupId=558715

4. Bangkele EY. Persepsi Orang Tua, Guru Dan Tenaga Kesehatan Tentang Obesitas Pada Anak Dan Remaja. Heal Tadulako J (Jurnal Kesehat). 2023;9(1):58–64. Available from: https://jurnal.fk.untad.ac.id/index.php/htj/article/view/658
5. Puspitasari N. Kejadian Obesitas Sentral pada Usia Dewasa. HIGEIA (Journal Public Heal Res Dev). 2018;2(2):249–59.
6. Masrul M. Epidemi obesitas dan dampaknya terhadap status kesehatan masyarakat serta sosial ekonomi bangsa. Maj Kedokt Andalas. 2018;41(3):152.
7. Santika IGPNA. Karbohidrat. J Ilmu Keolahragaan. 2019;13(2):38–44.
8. Herumuryawan M, Sakundarno M, Wahyu Subagio H, Soemantri A. Hipertensi pada Obesitas Masa Anak. Media Medika Indonesiana. 2010;44(1):1–7.
9. Sofa IM. Kejadian Obesitas, Obesitas Sentral, dan Kelebihan Lemak Viseral pada Lansia Wanita. Amerta Nutr. 2018;2(3):228.
10. Ghesmaty Sangachin M, Cavuoto LA, Wang Y. Use of various obesity measurement and classification methods in occupational safety and health research: A systematic review of the literature. BMC Obes. 2018;5(1).
11. Rahayu LAD, Admiyanti JC, Khalda YI, Ahda FR, Agistany NFF, Setiawati S, et al. Hipertensi, Diabetes Mellitus, Dan Obesitas Sebagai Faktor Komorbiditas Utama Terhadap Mortalitas Pasien Covid-19: Sebuah Studi Literatur. JIMKI J Ilm Mhs Kedokt Indones. 2021;9(1):90–7.
12. Delima DP, Prasetio RT. Sistem Pakar Diagnosa Komplikasi Obesitas Pada Remaja Menggunakan Metode Certainty Factor. eProsiding Sist Inf. 2021;2(1):51–60.
13. Listiyana AD, Mardiana M, Prameswari GN. Obesitas sentral dan kadar kolesterol darah total. J Kesehat Masy. 2013;9(1):37–43.
14. World Health Organization (WHO). The Asia–Pacific perspective: redefining obesity and its treatment. Health Communications Australia. 2000.
15. Lestari, Zulkarnain, Sijid SA. Diabetes Melitus: Review Etiologi, Patofisiologi, Gejala, Penyebab, Cara Pemeriksaan, Cara Pengobatan dan Cara Pencegahan. UIN Alauddin Makassar [Internet].

E-ISSN :2722-0877

2021;(November):237–41. Available from: [tautan mencurigakan telah dihapus]
16. Adam L. Determinan Hipertensi Pada Lanjut Usia. Jambura Heal Sport J. 2019;1(2):82–9.
17. Arnisam SW. Pengaruh Obesitas Terhadap Kejadian Penyakit Jantung Koroner (PJK) Di Puskesmas Darul Iman Aceh Besar. Biology Education. 2019;7:69–81.
18. Karczewski J, Begier-Krasińska B, Staszewski R, Popławska E, Gulczynska-Elhadi K, Dobrowolska A. Obesity and the Risk of Gastrointestinal Cancers. Dig Dis Sci. 2019;64(10):2740–9. Available from: https://doi.org/10.1007/s10620-019-05603-9
19. Umbu Henggu K, Nurdiansyah Y. Review dari Metabolisme Karbohidrat, Lipid, Protein, dan Asam Nukleat. Quim J Kim Sains dan Terap. 2022;3(2):9–17.
20. Utami D. Hubungan Asupan Karbohidrat Sederhana, Serat Dan Kepatuhan Minum Obat Hipoglikemik Oral (OHO) Dengan Kadar Glukosa Darah Pada Penderita Diabetes Melitus Di Puskesmas Sukamerindu Kota Bengkulu Tahun 2021. [Skripsi/Jurnal]. Available from: https://ejournal.unsrat.ac.id/index.php/JAP/article/viewFile/19239/18790
21. Fitri AS, Fitriana YAN. Analisis Senyawa Kimia pada Karbohidrat. Sainteks. 2020;17(1):45.
22. Intan SEN, Palupi NS, Prangdimurti E. Tingkat Asupan Makronutrien dan Gaya Hidup terhadap Risiko terjadinya Obesitas di Lima Provinsi di Indonesia. J Mutu Pangan Indones J Food Qual. 2022;8(2):88–96. doi:10.29244/jmpi.2021.8.2.88
23. Nurhasanah N, Pardede IT, Nauli F, Hayati I, Nasution FR, Hermawan AR. Analisis Asupan Karbohidrat dan Lemak pada Dewasa Muda dengan Obesitas Sentral di Fakultas Kedokteran Universitas Riau. J Ilmu Kedokt (Journal Med Sci). 2022;16(1):16. doi:10.26891/jik.v16i1.2022.16-21
24. Loong SCP, Mayulu N, Kawengian SES. Hubungan Antara Asupan Zat Gizi Makro Dengan Obesitas Pada Wanita Usia Subur Peserta Jamkesmas Di Puskesmas Wawonasa Kecamatan Singkil Manado. J e-Biomedik. 2013;1(1):607–13. doi:10.35790/ebm.1.1.2013.4607
25. Kurniawati U, Sarbini D, Muwakhidah M, Mardiyati NL. Literature Review: Hubungan Antara Lingkar Pinggang Dengan Kejadian Diabetes Melitus Pada Individu

E-ISSN :2722-0877

Dewasa Dan Lansia. J Kesehat. 2022;15(2):172–85. doi:10.23917/jk.v15i2.19628

26. Rahayuningsih AN, Muniroh L. Hubungan Aktivitas Fisik, Asupan Kalsium dan Lemak dengan Obesitas Sentral pada Tenaga Kerja Perkantoran. Media Gizi Kesmas. 2022;11(2):351–7. doi:10.20473/mgk.v11i2.2022.351-357
27. Utami RW, Sofia SN, Murbawani EA. Lipid Pada Pasien Penyakit Jantung Koroner. J Kedokt Diponegoro. 2017;6(2):1143–55.
28. Prikhatina RA. Status Gizi (IMT) Sebagai Faktor Dominan Kejadian Obesitas Sentral Pada Pegawai Pemerintahan Kota Bekasi Tahun 2015. J Kedokt. 2018:53–4.
29. Hardianwarsari C, Nugroho PRH, Purwanti R. Hubungan Indeks Massa Tubuh (IMT) Dan Lingkar Perut (LP) Terhadap Kadar Kolesterol Total Di Pos Pembinaan Terpadu (Posbindu) Baciro Gondokusuman Yogyakarta. J Permata Indones. 2022;13(2):145–54. doi:10.59737/jpi.v13i2.173
30. Kharismawati R, Sunarto. Association between level of energy, protein, fat, carbohydrate, and fiber intakes with obesity status at elementary school children. [Tugas Akhir]. Universitas Diponegoro; 2010. Available from: http://eprints.undip.ac.id/25406/2/354_Ririn_Kharismawati_G2C308014.pdf
31. Patmala R. Hubungan konsumsi karbohidrat dan lemak dengan kejadian obesitas pada wanita usia 30-65 tahun di Kecamatan Giritontro Kabupaten Wonogiri. [Internet]. Published online 2023.