

The risk factors of obesity among adolescents during the covid-19 pandemic in the province of north sumatera

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Abstract

Objectives: The COVID-19 pandemic has resulted in low levels of physical activity in adolescents and an increase in diet and frequency of irregular eating in adolescents due to the social restrictions of the COVID-19 pandemic. **Methods:** This research was conducted using a quantitative analytic approach with a cross-sectional study design. This study population were all adolescents aged 15-23 years at junior high school, high school, vocational high school, and university. The sample in this study were 127 adolescents. Data collection

uses primary data online (Google form). The research instrument used the GPAQ (Global Physical Activity Questionnaire) questionnaire and the FFQ (Food Frequency Questionnaire) questionnaire instrument. The data analysis of this study used univariate analysis and bivariate analysis using the chi-square test. **Result :** The study results had a significant relationship between the history of obesity and the incidence of obesity. In adolescents during the COVID-19 pandemic ($p = 0.000$; $PR = 3,930$), there was a significant relationship between carbohydrate consumption patterns and the incidence of obesity in adolescents during the COVID-19 pandemic ($p = 0.005$; $PR = 1.423$), there was a significant relationship There is a significant difference between the pattern of consumption of vegetable protein and the incidence of obesity in adolescents during the COVID-19 pandemic ($p = 0.043$; $PR = 2.305$), there is a significant relationship between the pattern of consumption of animal protein and the incidence of obesity in adolescents during the COVID-19 pandemic ($p = 0.031$; $PR = 2.287$), and there is a significant relationship between the pattern of fast food consumption and the incidence of obesity in adolescents during the COVID-19 pandemic ($p = 0.018$; $PR = 1.575$). **Conclusion :** This study concludes that there is a significant relationship between a history of obesity and the incidence of obesity in adolescents, there is a significant relationship between patterns of carbohydrate consumption, there is a significant relationship between patterns of consumption of vegetable protein, there is a significant relationship between patterns of animal protein, there is a significant relationship between fast food consumption patterns on the incidence of obesity in adolescents during the COVID-19 pandemic. **Keyword:** Obesity, adolescence, physical activity, diet, COVID-19.

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Introduction

As of 12 March 2020, Coronavirus Disease (COVID-19) has been declared a pandemic in the world by the World Health Organization (WHO) (1). The COVID-19 pandemic has given Indonesia affect adolescents groups that experienced stress and anxiety over the changes that have occurred. It caused adolescents change in their daily consumption intake (2). A proper diet remains very important in COVID-19 pandemic; eating foods that contain adequate and balanced nutrition helps adolescents in the process of improving and boosting their immune systems (3).

During the COVID-19 pandemic, distance learning education has been introduced namely school from home by the Indonesian Minister of Education and Culture (4). School from home learning is carried out by almost all educational institutions that aiming to break the chain of transmission and spread of the COVID-19 virus at school (5). Online learning methods make children focus on gadgets that causes children to become obese and can have a negative impact (6).

The COVID-19 pandemic has resulted in low levels of physical activity in adolescents due to students' irregular eating patterns after returning to their homes due to the COVID-19 pandemic (7). Lack of activity carried out by adolescents in terms of expending energy can increase the risk of obesity. Low physical activity has a risk factor of 1.2 times greater that can cause obesity in adolescents compared to a physical activity carried out in the moderate and heavy groups (8). The high incidence of obesity is a complex phenomenon influenced by the environment, lack of physical activity, high-fat foods, and dense calories. These risk factor are associated with that sedentary activities (lack of physical activity) such as watching television, playing video games, and using computers (9).

The World Health Organization (WHO) reports obesity cases in America by 37% at 6-11 years of age and 34% in adolescents 12-19 years old group. The high prevalence of obesity in adolescents is more than 32% than in adults categorized as obese (10). In several European countries, such as the United Kingdom, the United States, there were 3,615 positive cases of COVID-19, which had a problem of being overweight by 21% and obesity by 16% (11). Indonesia is in second rank, with 12.2% obesity in adolescents (12). Based on

Indonesia health survey in 2013, it was stated that the prevalence of adolescent obesity was 15.4% and reported increasing in 2018 (21.8%) (13).

The social restrictions that the government takes to prevent the spread of the COVID-19 virus, which causes the risk of weight and obesity cases in Indonesia was increase (14). In adolescents with excess energy intake (carbohydrates, fat, protein) will be 2.92 times more likely to suffer from obesity than adolescents who do not have excess energy (15). Adolescents consuming excess carbohydrates are 4 times more likely to be obese than adolescents who consume enough carbohydrates (15). Poor physical activity for adolescents will have a 21 times the risk of suffering from obesity compared to adolescents who do good physical activity (16,17). Excessive consumption of fast food in adolescents has a 1.46 times risk of experiencing overweight higher compared with adolescents who rarely eat *fast food* (18). Adolescents who have heredity from their parents are 1.5 times more likely to be obese than adolescents who do not have a history of obesity (15).

During the COVID-19 pandemic, there have been many changes in lifestyle behaviours such as an increase in food consumption patterns and eating frequency in adolescents due to social restrictions in preventing the spread of COVID-19, lack of physical activity in adolescents resulting in lack of movement and leading to obesity in adolescents during the COVID-19 pandemic in The Province of North Sumatra. This study was conducted to determine factors associated with incidence of obesity in adolescents during the COVID-19 pandemic in The Province of North Sumatra.

Methods

Study Setting

This study was located in the Province of North Sumatra, Indonesia that the largest province in western part of Indonesia and also Sumatera Island. Data collection was obtained through a self-administered online questionnaire which contained questions on demographic characteristics, physical activity and frequency of consumption of carbohydrates, protein, vegetable protein, vegetables, fruit, and fast food. This study used non-random sampling techniques, namely using purposive sampling technique. The inclusion criteria in this study were adolescents aged 15-23

years, living and living in North Sumatra Province, while the exclusion criteria in this study were adolescents not aged 15-23 years, did not live and resided in North Sumatra Province. The independent variables in this study are demographic characteristics, physical activity, frequency of consumption of carbohydrates, animal protein, vegetable protein, vegetables, fruits, and fast food.

Instruments

The research instrument used the GPAQ (Global Physical Activity Questionnaire) questionnaire instrument which is useful for measuring the level of physical activity originating from WHO. Total Physical Activity is obtained from the GPAQ formula in MET minutes / week. Metabolic Equivalent of Task (MET) is a unit whose purpose is to calculate the amount of energy physical activity expended. Based on the GPAQ (Global Physical Activity Questionnaire), there are three categories calculated from the Metabolic Equivalent of Task (MET), namely the categories of heavy physical activity, moderate physical activity and light physical activity. The grouping of physical activity in this study is based on the GPAQ questionnaire obtained, such as light physical activity if the value is (MET \leq 3000 minutes / week), moderate activity if the value is (MET \geq 601-2999 minutes / week) and light activity if the value is (MET <600). minutes / week. In this study, physical activity categories were grouped into 2 categories, namely heavy and light activities. In this study, moderate to heavy activities were categorized into strenuous activities. Meanwhile, the FFQ (Food Frequency Questionnaire) questionnaire instrument. The Ministry of Health of the Republic of Indonesia to measure the frequency of carbohydrates, animal protein, vegetable protein, vegetables, fruits, and fast food. In this study, dietary consumption patterns were grouped into 2 categories, namely risk categories and non-risk categories. Body Mass Index (BMI) was obtained from the calculation which uses the formula (Weight (kg) / (Height (m) ² in kg / m²).

Data Analysis

The data analysis of this study used univariate analysis and bivariate analysis using the chi-square test. Univariate analysis was used to analyze the independent variables (age, gender, allowance / day, father's latest education, mother's last education, socioeconomic status of parents, occupation of parents, history of obesity, and

nutritional status. see the relationship between the independent and dependent variables. The dependent variable is age, gender, allowance / day, father's last education, mother's last education, parents' socioeconomic status, parental occupation, and history of obesity. While the dependent variable is obesity. In this study, all data analyzed were categorical data types with the chi-square test. Decisions were taken from this analysis test by looking at the p value and the prevalence rate (PR) with a confidence level of 95%.

Result

This study reported the majority of respondents are aged \geq 17 years (93.7%) and female (79.5%). The prevalence of obesity in the study location is 24.4%.

Table 1. Frequency Distribution based on Respondent Characteristics (n = 127)

+Characteristics	n	%
Age (years)		
\leq 17 years	8	6.3
\geq 17 years	119	93.7
Gender		
Man	26	20.5
Women	101	79.5
Allowance/day		
High	86	67.7
Low	41	32.3
Father's Last Education		
High	111	87.4
Low	16	12.6
Mother's Last Education		
High	107	84.3
Low	20	15.7
Parents' Socioeconomic		
High	84	66.1
Low	43	33.9
Parents' job		
Government employees	31	24.4
Private employees	96	75.6
Obesity History		
Yes	22	17.3
Not	105	82.7
Nutritional status		
Obesity	31	24.4
Not obese	96	75.6

Table 2 shows that the history of obesity, carbohydrates, protein were associated with obesity. Adolescent who having obesity history are probability to be obesity 3 time higher comparing

with no obesity experience. In line with this finding, adolescent that high food intake of fast food were 1.5 time higher to be obesity compare with other. Adolescent who were consuming fast food were 1.5

time higher to be obesity compare with other. However, characteristic demographic of respondent showed no association to risk factor of obesity among adolescents.

Table 2. Relationship of risk factors for obesity in adolescents during the COVID-19 pandemic

Risk factors	Obesity		Not Obesity		amount n	p-value	PR (95% CI)
	n	%	n	%			
Age							
<17 years	1	11.1	8	88.9	9	0.335	0.437 (0.067-2,846)
> 17 years	30	24.4	88	74.6	118		
Gender							
Man	3	11.5	23	88.5	26	0.087	0.416 (0.137-1,263)
Women	28	27.7	73	72.3	101		
Allowance/day							
High	22	25.6	64	74.4	86	0.656	1,165 (0.590-2,301)
Low	9	22.0	32	78.0	41		
Father's Last Education							
Low	2	12.5	14	87.5	16	0.236	0.463 (0.122-1,752)
High	29	26.1	82	73.9	111		
Mother's Last Education							
Low	2	10.0	18	90.0	20	0.102	0.369 (0.096-1,425)
High	29	27.1	78	72.9	107		
Parents' Socio economic							
High	21	25.0	63	75.0	84	0.829	1,075 (0.557-2,074)
Low	10	23.3	33	76.7	43		
Parents' job							
Government employees	6	19.4	25	80.6	31	0.451	0.743 (0.336-1,644)
Private employees	25	26.0	71	74.0	96		
Obesity History							
Yes	14	63.6	8	36.4	22	0,000	3,930 (2,194-6,281)
Not	17	16.2	87	83.8	105		
Physical Activity							
High	22	25.9	63	74.1	85	0.543	1,208 (0.611-2,388)
Low	9	21.4	33	78.6	42		
Consuming Carbohydrates							
Risk	17	18.1	77	81.9	94	0.005	1,423 (1,046-1,936)
No risk	14	42.4	19	57.6	33		
Consuming Vegetable Protein							
Risk	26	29.5	62	70.5	88	0.043	2,305 (0.956-5,554)
No risk	5	12.8	34	87.2	39		
Consuming Animal Protein							
Risk	25	30.5	57	69.5	82	0.031	2,287 (1,014-5,158)
No risk	6	13.3	39	86.7	45		
Consuming of Vegetables							
Risk	23	22.3	80	77.7	103	0.258	0.670 (0.343-1,310)
No risk	8	33.3	16	66.7	24		
Consuming Fruits							
Risk	23	21.5	84	78.5	107	0.077	0.537 (0.281-1,027)
No risk	8	40.0	12	60.0	20		
Consuming Fast Food							
Risk	24	21.2	89	78.8	113	0.018	1,575 (0.925-2,683)
No risk	7	50.0	7	50.0	14		

Discussion

This study highlighted significant association between a history of obesity and the incidence of obesity in adolescents during the COVID-19 pandemic. This is caused by genetic factors associated with the chance of increasing body weight, frequency of overeating, and lack of the same activity in the surrounding area. Other research also states that adolescents who have Obese from parents have 1.5 times higher risk of suffering from obesity than adolescents who do not have obesity (genes) from their parents (15). This is caused by eating irregularly, like eating fast food such as fast food and lack of physical activity. This is in line with research that states that a history of obesity in parents is 9.79 times more likely to become obese in adolescents (19). The problem of obesity in one of the fathers and mothers suffering from obesity is 11.82% can reduce it to the child. Meanwhile, if the father and mother both suffer from obesity, 21.95% of children suffering from obesity will increase. A history of obesity in both parents had a 3 times risk of passing on genetic factors to the child than parents who were not obese (20). Another factor, one of which is the DNA that humans have. A healthy underweight person cannot be obese because they have genes that are associated with a chance of gaining weight. This also causes people to stay thin even though they eat a lot of food (21).

This study found that there is a significant relationship between carbohydrate consumption patterns and the prevalence of obesity in adolescents during the COVID-19 pandemic. The result of the prevalence ratio (PR) value is 1.423, meaning that respondents who have an excess carbohydrate consumption pattern are 1.4 times more likely to be obese than respondents who do not consume excess carbohydrates with a confidence level (95% CI = 1.046-1.936). This study is in line with research that states an association between carbohydrate intake and obesity in adolescents at 1.24 times risk (22). Obese children state that obese children have more carbohydrate adequacy than the nutritional adequacy rate (23). Excess consumption of carbohydrates will be stored in the form of glycogen but in limited quantities, and the rest will be stored in the form of fat. Increased fat stored in the body due to excessive calorie intake cannot be converted into energy used as a source of energy for physical activity, which can lead to obesity (24). The average carbohydrate intake of adolescents who are obese is 1228.8 kcal/day,

more than adolescents who are not obese, namely 1092 kcal/day (25). Foods that contain carbohydrates such as rice, noodles, bread, milk, fried foods, and packaged drinks are food habits that are often consumed among adolescents, which results in adolescents becoming obese (26).

Based on the study results, there is a significant relationship between protein intake and obesity in adolescents during the COVID-19 pandemic. This study's results are in line with the results of research that showed a $p < 0.001$, which means that there is a relationship between consumption of vegetable protein and obesity in adolescents (27). Vegetable protein intake in obese adolescents is more at risk than adolescents who are not obese (27). Based on the results of other studies, it states that excess protein intake will make amino acids into deaminase so that the body will excrete nitrogen, and the remaining carbon bonds will be converted into acetyl CoA, which will be synthesized into triglycerides by the lipogenesis process which will be stored in the body. This causes an increase in fat tissue and makes BMI status more (more nutritional) (28). This study is in line with research that states that consuming excess animal protein is the cause of obesity in adolescents (27). a person who consumed animal protein had a 1.18 times risk of obesity. This is because animal protein is a high-fat food source; besides, teenagers are also very fond of eating foods containing fat and fried (29). The amount of 9 amino acids in animal protein is a perfect proportion in the human body (complete protein). Foods that are high in animal protein contain cholesterol, and high protein fatty acids are bad health effects and lead to obesity. The cause of insulin resistance is the consumption of animal protein and saturated fatty acids. Protein sources are food ingredients containing amino acid arginine, histidine, and leucine, which can increase insulin secretion and are associated with fat metabolism (30).

Similar result also found on fast food intake among adolescent. This study's results are in line with Alam's (2019) study, which states that adolescents who frequently eat *fast food* have a three times risk of suffering from obesity compared to adolescents who rarely consume *fast food* (31). Someone who often consumes fast food causes excess weight (obesity) because of the high energy, sugar, fat, low fibre, sodium, and saturated fat contained in fast food and is a harmful impact on

the emergence of health problems future (32). Among adolescents, it is easy to get food from restaurants, such as fast food consumption. The number of teenagers getting food through delivery services can make it easier for teenagers to get *fast food*. Teenagers are also presented with fast food posts on various social media (33). Given that during the COVID-19 pandemic, people were encouraged to stay at home, business strategies emerged starting from various promos available, such as free shipping. The discounted prices to become a strong reason to order everything you need through the internet media (34).

Conclusion

High risk factor of obesity among adolescent is associated with food intake including fast food intake and obesity history. Dietary consumption is needed to prevent obesity among adolescent in the future.

References

1. WHO. Coronavirus disease (COVID-19) outbreak: rights, roles and responsibilities of health workers, including key considerations for occupational safety and health: interim guidance, 19 March 2020 (No. WHO/2019-nCov/HCW_advice/2020.2). Geneva; 2020.
2. Alamrawy RG, Fadl N, Khaled A. Psychiatric morbidity and dietary habits during COVID-19 pandemic: a cross-sectional study among Egyptian Youth (14–24 years). *Middle East Curr Psychiatry, Ain Shams Univ.* 2021;28(1):6.
3. Kołota A, Głabska D. Covid-19 pandemic and remote education contributes to improved nutritional behaviors and increased screen time in a Polish population-based sample of primary school adolescents: diet and activity of youth during COVID-19 (DAY-19) study. *Nutrients.* 2021;13(5):1596.
4. Kementerian Pendidikan Dan Kebudayaan. Pedoman Penyelenggaraan Belajar Dari Rumah Dalam Masa Darurat Penyebaran Corona Virus Disease (Covid-19). Surat Edaran Nomor 15 Tahun 2020 TENTANG PEDOMAN PEIYELENGGARAAN BELAJAR DARI RUMAH DALAM MASA DARURAT PENYEBARAN CORONA YIRUS D/SEASE. 2020;(15):1–20.
5. El Refae GA, Kaba A, Eletter S. Distance learning during COVID-19 pandemic: satisfaction, opportunities and challenges as perceived by faculty members and students. *Interact Technol Smart Educ.* 2021;18(3):298–318.
6. Rowan C. 10 Reasons Why Handheld Devices Should Be Banned for Children Under the Age of 12. 2017.
7. Khidri FF, Riaz H, Bhatti U, Shahani KA, Kamran Ali F, Effendi S, et al. Physical Activity, Dietary Habits and Factors Associated with Depression Among Medical Students of Sindh, Pakistan, During the COVID-19 Pandemic. *Psychol Res Behav Manag.* 2022 May;Volume 15:1311–23.
8. Mahumud RA, Sahle BW, Owusu-Addo E, Chen W, Morton RL, Renzaho A. Association of dietary intake, physical activity, and sedentary behaviours with overweight and obesity among 282,213 adolescents in 89 low and middle income to high-income countries. *Int J Obes.* 2021;45(11):2404–18.
9. Alghadir A, Iqbal Z, A. Gabr S. The Relationships of Watching Television, Computer Use, Physical Activity, and Food Preferences to Body Mass Index: Gender and Nativity Differences among Adolescents in Saudi Arabia. *Int J Environ Res Public Health.* 2021 Sep;18(18):9915.
10. World Health Organization. Taking action on childhood obesity report. *World Heal Organ.* 2018;1–8.
11. Lighter J, Phillips M, Hochman S, Sterling S, Johnson D, Francois F, et al. Obesity in Patients Younger Than 60 Years Is a Risk Factor for COVID-19 Hospital Admission. *Clin Infect Dis.* 2020 Jul;71(15):896–7.
12. United Nations Children’s Fund. Children in an Urban World. *state world’s Child* 2012. 2012;107.
13. Kementerian Kesehatan Republik Indonesia. Laporan Riskeddas Provinsi Sumatera Utara. Kementerian Kesehatan; 2018.
14. Sitoayu L, Mardiyah S, Melani V, Dewanti LP, Ronitawati P, Amelia SR, et al. Impact of the Covid-19 Pandemic on Changes in Weight, Consumption and Lifestyle in Indonesian Students. *Int J Multidiscip Appl Bus Educ Res.* 2021;2(12):1379–83.
15. Qatrunnada RD. Factors that Cause Overweight and Obesity in School-Age Children and Adult: A Literature Review. *Media Gizi Kesmas.* 2022;11(1):318–26.
16. Boričić K, Simić S, Vasiljević N, Marinković J. Risk Factors Associated with Overweight among Adolescents in Serbia. *Slov J Public Heal.* 2014 Dec;53(4):283–93.
17. López-Gil JF, Brazo-Sayavera J, de Campos W, Yuste Lucas JL. Meeting the Physical Activity Recommendations and Its Relationship with Obesity-Related Parameters, Physical Fitness, Screen Time, and Mediterranean Diet in Schoolchildren. *Children.* 2020 Nov;7(12):263.
18. Mohammadbeigi A, Asgarian A, Moshir E, Heidari H, Afrashteh S, Khazaei S, et al. Fast food consumption and overweight/obesity prevalence in students and its association with general and abdominal obesity. *J Prev Med Hyg.* 2018 Sep;59(3):E236–40.

19. Barbadoro P, Santarelli L, Croce N, Bracci M, Vincitorio D, Prospero E, et al. Rotating Shift-Work as an Independent Risk Factor for Overweight Italian Workers: A Cross-Sectional Study. Gong Y, editor. *PLoS One*. 2013 May;8(5):e63289.
20. Mistry SK, Puthussery S. Risk factors of overweight and obesity in childhood and adolescence in South Asian countries: a systematic review of the evidence. *Public Health*. 2015 Mar;129(3):200–9.
21. Riveros-McKay F, Mistry V, Bounds R, Hendricks A, Keogh JM, Thomas H, et al. Genetic architecture of human thinness compared to severe obesity. *PLoS Genet*. 2019;15(1):1–25.
22. Aprilia N, Widyaningsih V. The Association between Carbohydrate Intake, Fruit and Vegetable Consumption, and Obesity among Adult in Indonesia. In: *Promoting Population Mental Health and Well-Being. Masters Program in Public Health, Universitas Sebelas Maret*; 2019. p. 85–85.
23. Kozioł-Kozakowska A, Kozłowska M, Jagielski P. Assessment of diet quality, nutrient intake, and dietary behaviours in obese children compared to healthy children. *Pediatr Endocrinol Diabetes Metab*. 2020;26(1):27–38.
24. Vijayakumar P, Narayanasamy A, Vellingiri B. Excessive carbohydrate consumption and body mass index: the risk factors for type 2 diabetes mellitus in patients with Prader-Willi syndrome in Tamil Nadu population. *J Basic Appl Zool*. 2018 Dec;79(1):54.
25. Rahayu ES, Kandarina BJI, Julia M. Source of energy intake of Papuan and non-Papuan high-school students in Jayapura: their association with risk for overweight/ obesity. *J Gizi Klin Indones*. 2020 Apr;16(4):137–42.
26. Brettschneider A-K, Lage Barbosa C, Haftenberger M, Lehmann F, Mensink GB. Adherence to food-based dietary guidelines among adolescents in Germany according to socio-economic status and region: results from Eating Study as a KiGGS Module (EsKiMo) II. *Public Health Nutr*. 2021;24(6):1216–28.
27. Lin Y, Mouratidou T, Vereecken C, Kersting M, Bolca S, de Moraes ACF, et al. Dietary animal and plant protein intakes and their associations with obesity and cardio-metabolic indicators in European adolescents: the HELENA cross-sectional study. *Nutr J*. 2015 Jan;14:10.
28. Lanham-New SA, MacDonald IA, Roche HM. *Nutrition and Metabolism: Second Edition*. Nutrition and Metabolism: Second Edition. 2011.
29. Alkerwi A, Sauvageot N, Buckley JD, Donneau A-F, Albert A, Guillaume M, et al. The potential impact of animal protein intake on global and abdominal obesity: evidence from the Observation of Cardiovascular Risk Factors in Luxembourg (ORISCAV-LUX) study. *Public Health Nutr*. 2015 Jul;18(10):1831–8.
30. Bujnowski D, Xun P, Daviglus ML, Van Horn L, He K, Stamler J. Longitudinal Association between Animal and Vegetable Protein Intake and Obesity among Men in the United States: The Chicago Western Electric Study. *J Am Diet Assoc*. 2011;
31. Alam MM, Hawlader MDH, Wahab A, Hossain MD, Nishat SA, Zaman S, et al. Determinants of overweight and obesity among urban school-going children and adolescents: a case-control study in Bangladesh. *Int J Adolesc Med Health*. 2021 Mar;33(1).
32. Singh S A, Dhanasekaran D, Ganamurali N, L P, Sabarathinam S. Junk food-induced obesity- a growing threat to youngsters during the pandemic. *Obes Med*. 2021 Sep;26:100364.
33. Chung A, Vieira D, Donley T, Tan N, Jean-Louis G, Kiely Gouley K, et al. Adolescent Peer Influence on Eating Behaviors via Social Media: Scoping Review. *J Med Internet Res*. 2021 Jun;23(6):e19697.
34. Febrilia I, Warokka A. Consumer traits and situational factors: Exploring the consumer's online impulse buying in the pandemic time. *Soc Sci Humanit Open*. 2021;4(1):100182.

