KEMAS 20 (4) (2025) 662-670

Jurnal Kesehatan Masyarakat

http://journal.unnes.ac.id/nju/index.php/kemas

Central Obesity in Children and Adolescent: Current Themes and Future Potential Researches

Annang Giri Moelyo[1] ✉, Hanum Ferdian[1], Nanang Wiyono[1]

[1]Sebelas Maret University

Article Info

Article History:
Submitted March 2024
Accepted October 2024
Published: April 2025

Keywords:
obesity; central obesity; children; adolescent

DOI
https://doi.org/10.15294/kemas.v20i4.2898

Abstract

The increasing prevalence of central obesity among children and adolescents is a significant concern for public health, as it can lead to various health risks and complications. This study aimed to provide comprehensive updates using the keywords "central obesity," and "children" or "adolescent". The Scopus electronic database was searched for relevant articles to compile the basic publishing and citation data found in the article's title, abstract, and keyword. The author, country, journal, and keyword networks were visualized using the bibliometric software program VOSviewer and biblioshiny. Of 1,190 articles, this study suggests the growth advancement with a 7.84% annual growth rate. The Plos One is the most international publication. The United States is the country leading in this topic. We find four theme clusters: obesity, central obesity, metabolic syndrome, and adolescents. The analysis shows that the diagnosis through anthropometric measurements, body fat assessment, metabolic syndrome, and complications were the major well-known research. The growing interest and future interest topics were waist-to-hip ratio, waist-to-height ratio, lifestyle, adiposity, and dyslipidemia. This bibliographic study showed the expanding publications of central obesity in children and adolescents and suggested several critical themes for future research.

Introduction

Concern about childhood and adolescent obesity is growing worldwide, with significant regional, socioeconomic, and gender variations (Wong *et al.*, 2020). The rates of obesity among children and adolescents vary widely, with older individuals, females, urban dwellers, Caucasians, and those from higher-income countries being more frequently affected. In Finland, the prevalence of childhood obesity is 8.7%. In the US, it is over 18%, and in some regions of China, it is as high as 28.6% (Sarkkola *et al.*, 2021; Deal *et al.*, 2020; Zhang *et al.*, 2021).

Central obesity in children and adolescents poses several health risks and complications that persist into adulthood and can impair quality of life. There are numerous short- and long-term health risks associated with this condition, such as those related to metabolism, cardiovascular health, and psychological problems (Bendor *et al.*, 2020; Faienza *et al.*, 2020; Jebeile *et al.*, 2021). However, there is a lack of published bibliometric studies, particularly using the Scopus database, that examine the scientific literature on this topic. Previous bibliometric studies used Web-of-Science (WoS) as a database (Coronado-Ferrer *et al.*, 2022; Kawuki *et al.*, 2022). The Scopus database is known to have the same status as WoS as a bibliographic data source. It is reliable and might be better than WoS (Pranckute, 2021). This study aims to provide comprehensive updates on the problems of central obesity in children and adolescents using the keywords "central obesity," and "children" or "adolescent".

Method

The Scopus database search engine was

✉ Correspondence Address:
Sebelas Maret University
Email: annanggm73@gmail.com

pISSN 1858-1196
eISSN 2355-3596

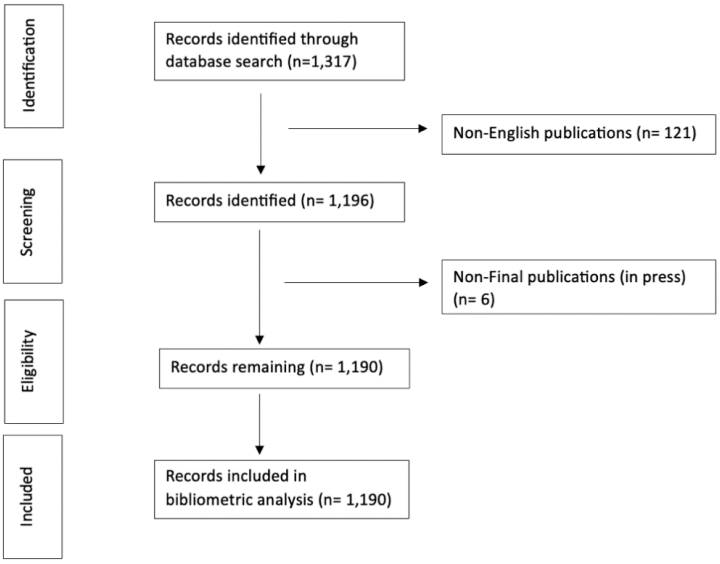


FIGURE 1. Flow-Chart Diagram of the Literature Search Process

applied in February 2024 to compile the basic publishing and citation data in the article's title, abstract, and keyword. The search terms included ("central obesity" AND child OR adolescent) and we were limited to only English publications regardless of the period of publication **(Fig.1).** After finding 1,190 articles, we exported them as CSV files. We used Scopus 'Analyze Result', VOSviewer 1.6.19, and Biblioshiny to visualize and analyze the co-occurrence of words and phrases in the titles and abstract keywords. We determined and limited the minimum 10 number of occurrences of the author keyword. Co-occurrence clusters represented by various colors were revealed by the author's keyword co-occurrence network analysis. The frame size corresponds to the occurrence of the keyword. The thickness is proportionate to the co-occurrence strength. The yellow keywords appeared later (2017 or later) than the blue ones (2015 or earlier), as the overlay visualization. The density visualization displayed the density of each term, and the thickness displayed more density.

Result And Discussion

Publications & publications growth

Out of 1,190 articles, we found a total of 1057 articles (88.8%), 88 reviews (7.4%), 15 conference papers (1.4%), and 14 book chapters (1.2%). The amount of research on central obesity in children and adolescents is growing. **(Fig.2)** The annual growth rate of publications was 7.84%, with international co-authorships, was 27.31%, and average citation perdoc was 32.93.

There were increments in articles regarding this subject since 2005, after a relatively low number of publications from 1990 to 2005. There was an annual increase in publications from 2005 to 2015, respectively (an average of 30 percent annual growth rate in publications). The publication rate (60–80 documents/year) remained relatively constant from 2015 until 2023. (**Fig.1**) Previous bibliometric studies revealed that the number of articles increased with the annual number of articles increasing steadily from 7.6% in 2010 to 12.1% in 2019, with the total number of articles more than twelve thousand (Coronado-Ferrer *et al*., 2022). The significant increase could be due to global awareness of obesity problems worldwide (Spinelli *et al*., 2021; González-Álvarez *et al*., 2020; Caprio *et al*., 2020).

Journal sources, countries, authors, and most cited articles

The Plos One is the most international publication with 30 documents, followed by the International Journal of Obesity (27), BMC Public Health (21), and Nutrients (21). The

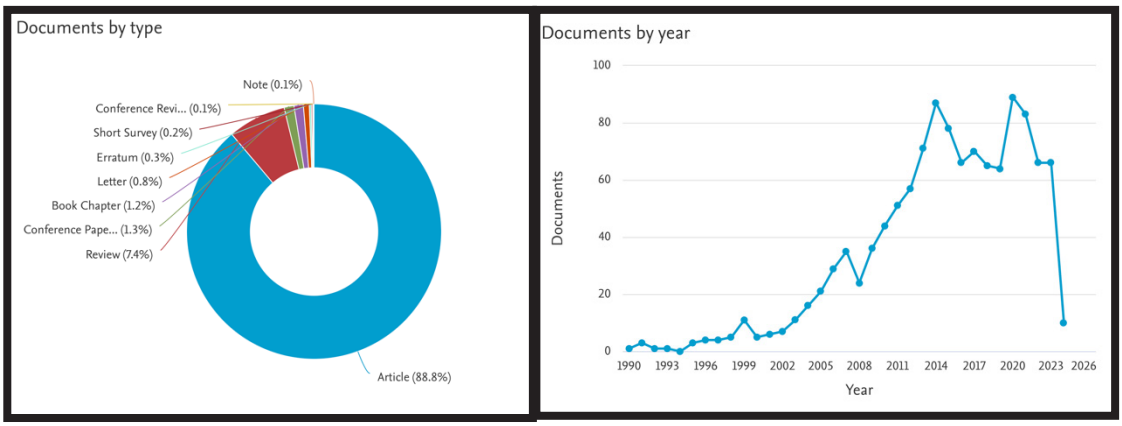


FIGURE 2. Publications types and publications growth

next other journals were Journal of Clinical Endocrinology and Metabolism (16), Journal of Pediatric Endocrinology And Metabolism (16), International Journal of Environmental Research And Public Health (15), Metabolic Syndrome And Related Disorders (13), Nutrition Metabolism And Cardiovascular Diseases (12), and Public Health Nutrition (12), respectively. Eight of the top ten journals had SNIP (Source Normalized Impact per Paper) scores higher than 1. Only one of the top 10 journals focuses on pediatric endocrinology, and three focus on nutrition. A similar result from a previous bibliometric study in WoS found that the International Journal of Obesity, BMC Public Health, and Plos One were the fourth largest journal sources despite Pediatric Obesity (Coronado-Ferrer *et al.*, 2022). Our study revealed that Pediatric Obesity had only 6 articles. Journals focused on pediatric obesity had fewer articles than other journals not focused/specific on this topic.

Most publications with 245 articles (20.6%) were provided by the United States, followed by China with 176 (14.8%), the United Kingdom with 109 (9.2%), and India with 87 (7.3%). The following most productive countries were Brazil, Iran, Spain, Australia, Italy, and Greece, respectively. US and UK were also the most articles in previous studies (Coronado-Ferrer *et al.*, 2022; Kawuki *et al.*, 2022). Southeast Asia contributed only 43 articles (3.61%). Our research and the previous one had similar results in the Southeast countries (Coronado-Ferrer *et al.*, 2022). Southeast Asia countries had a small contribution (less than 20 articles/country in our study). The most prolific author on this topic is Youfa Wang (13), followed by Roya Kelishadi R (10), Labros S. Sidossis (9), and Jie Mi (9). **(Fig.3)**

Table 1 describes the top ten most cited articles. The most cited article is "A systematic

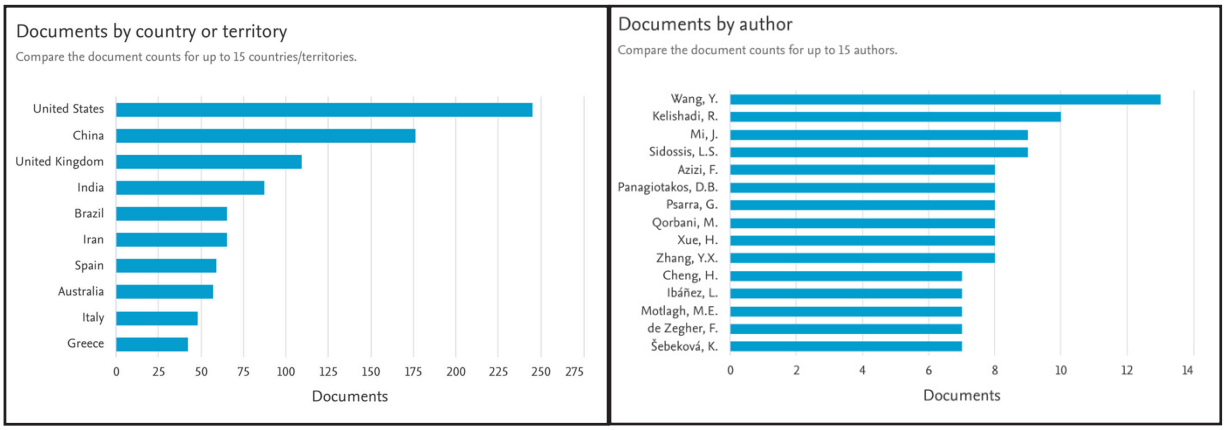


FIGURE 3. The source of countries and authors

TABLE 1. Top ten most cited articles

	Authors	Title	Year	Source title	Citation
1	Browning L.M.; Hsieh S.D.; Ashwell M (Browning *et al*., 2010)	A systematic review of waist-to-height ratio as a screening tool for the prediction of cardiovascular disease and diabetes: 0.5 could be a suitable global boundary value	2010	Nutrition Research Reviews	937
2	Oken E.; Gillman M.W (Oken & Gillman, 2003)	Fetal origins of obesity	2003	Obesity Research	715
3	Beales P.L.; Elcioglu N.; Woolf A.S.; Parker D.; Flinter F.A (Beales *et al.,* 1999)	New criteria for improved diagnosis of Bardet-Biedl syndrome: Results of a population survey	1999	Journal of Medical Genetics	663
4	Lim S.S.; Davies M.J.; Norman R.J.; Moran L.J (Lim *et al*., 2012)	Overweight, obesity and central obesity in women with polycystic ovary syndrome: A systematic review and meta-analysis	2012	Human Reproduction Update	553
5	De Heredia F.P.; Gómez-Martínez S.; Marcos A (de Heredia *et al.,* 2004)	Chronic and degenerative diseases: Obesity, inflammation and the immune system	2012	Proceedings of the Nutrition Society	511
6	Armitage J.A.; Khan I.Y.; Taylor P.D.; Nathanielsz P.W.; Poston L (Armitage *et al.,* 2004)	Developmental programming of the metabolic syndrome by maternal nutritional imbalance: How strong is the evidence from experimental models in mammals?	2004	Journal of Physiology	458
7	Daniels S.R.; Khoury P.R.; Morrison J.A (Daniels *et al*., 1997)	The utility of body mass index as a measure of body fatness in children and adolescents: Differences by race and gender	1997	Pediatrics	426
8	Ibáñez L.; Ong K.; Dunger D.B.; De Zegher F(Ibáñez *et al*., 2006)	Early development of adiposity and insulin resistance after catch-up weight gain in small-for-gestational-age children	2006	Journal of Clinical Endocrinology and Metabolism	419
9	Gunay-Aygun M.; Schwartz S.; Heeger S.; O'Riordan M.A.; Cassidy S.B (Gunay-Aygun *et al*., 2001)	The changing purpose of Prader-Willi syndrome clinical diagnostic criteria and proposed revised criteria.	2001	Pediatrics	394
10	Sahakyan K.R.; Somers V.K.; Rodriguez-Escudero J.P.; Hodge D.O.; Carter R.E.; Sochor O.; Coutinho T.; Jensen M.D.; Roger V.L.; Singh P.; Lopez-Jimenez F (Sahakyan *et al*., 2015)	Normal-weight central obesity: Implications for total and cardiovascular mortality	2015	Annals of Internal Medicine	361

review of waist-to-height ratio as a screening tool for the prediction of cardiovascular disease and diabetes: 0.5 could be a suitable global boundary value" by Browning L.M *et al* (2010) with 937 citations; followed by "Fetal origins of obesity" by Oken E. and Gillman M.W. (2003) (715 citations); and "New criteria for improved diagnosis of Bardet-Biedl syndrome: Results of a population survey" by Beales P.L *et al* (1999) (663 citations). The most cited articles with a focus on children and obesity were "The Utility of Body Mass Index as a Measure of Body Fatness in Children and Adolescents: Differences by Race and Gender" (Daniels 1997; 426 citations); and "Early Development of Adiposity and Insulin Resistance After Catch-up Weight Gain in Small-for-gestational-age Children" (Ibanez 2006; 419 citations). The most cited article topic is a waist-to-height ratio to diagnose obesity, although it is not discussed specifically for children and adolescents in this article (Browning *et al*., 2010). Previous bibliometric studies mentioned that the most cited article is a definition for diagnosing child overweight and obesity (Kawuki *et al*., 2022). The challenge in diagnosing central obesity in children and adolescents is to select the best anthropometric measurement with high specificity and sensitivity.

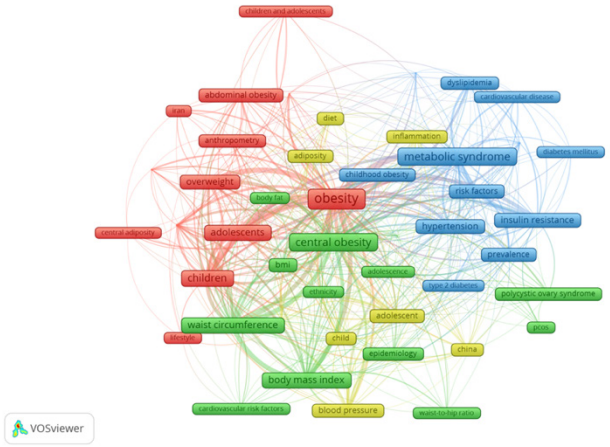
Co-occurrence clusters

Four theme clusters were found in the author's keyword co-occurrence network analysis (**Table 2, Fig. 4A**), which has a total of 46 item keywords, and "obesity", "central obesity", "metabolic syndrome", and "adolescents" are the densest terms in each cluster. The growing interest from 2016 until 2024 was overweight and obesity in children and adolescents, waist-to-hip ratio, waist-to-height ratio, lifestyle, adiposity, and dyslipidemia (**Fig. 4B**). Waist-to-hip ratio, waist-to-height ratio, lifestyle, and dyslipidemia could be chosen as the future interest topics to be further investigated because of the less density in our density visualization map **(Fig. 4C)**. The thematic evolution was performed in **Fig. 5A**. The themes in 2019-2024 were described in **Fig.5B.** Abdominal obesity and childhood obesity were the new interesting topics in this period.

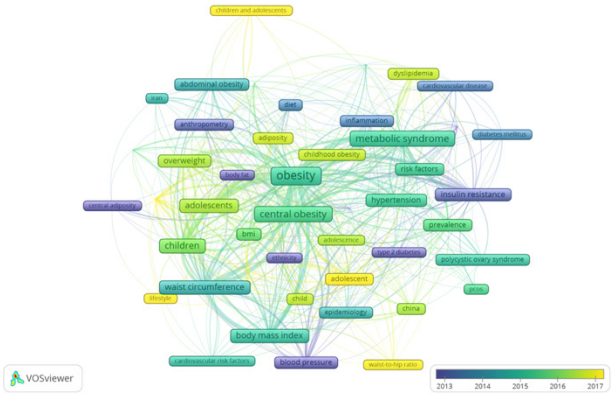
Cluster 1 revolves around broad themes of obesity, abdominal obesity, and central adiposity in children and adolescents, with various anthropometric measurements to diagnose them. In this cluster, we found the topic of lifestyle. The AAP clinical practice guidelines mentioned intensive health behavior lifestyle treatment as an approach to treat obesity in children and adolescent (Hampl *et al*., 2023). Cluster 2 revolves around a somewhat similar theme to Cluster 1, but has a more specific and narrower theme on central obesity, body fat, adolescent body composition, and several anthropometric measurements (body mass

TABLE 2. The author's keyword co-occurrence clusters

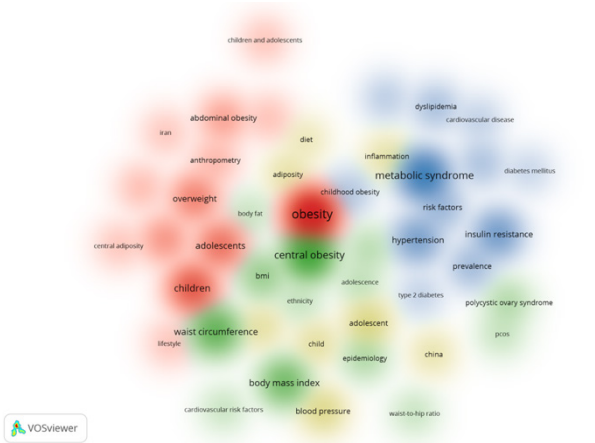
Cluster 1 (13 item)	Cluster 2 (13 item)	Cluster 3 (12 item)	Cluster 4 (8 item)
abdominal obesity	adolescence	cardiovascular disease	adiposity
adolescents	bmi	cardiovascular risk	**adolescent**
anthropometry	body composition	childhood obesity	blood pressure
central adiposity	body fat	diabetes	child
childhood	body mass index	diabetes mellitus	china
children	cardiovascular risk factor	dyslipidemia	diet
children and adolescents	**central obesity**	hypertension	inflammation
iran	epidemiology	insulin resistance	physical activity
lifestyle	ethnicity	**metabolic syndrome**	
neck circumference	pcos	prevalence	
obesity	polycystic ovary syndrome	risk factors	
overweight	waist circumference	type 2 diabetes	
waist-to-height ratio	waist-to-hip ratio		



A

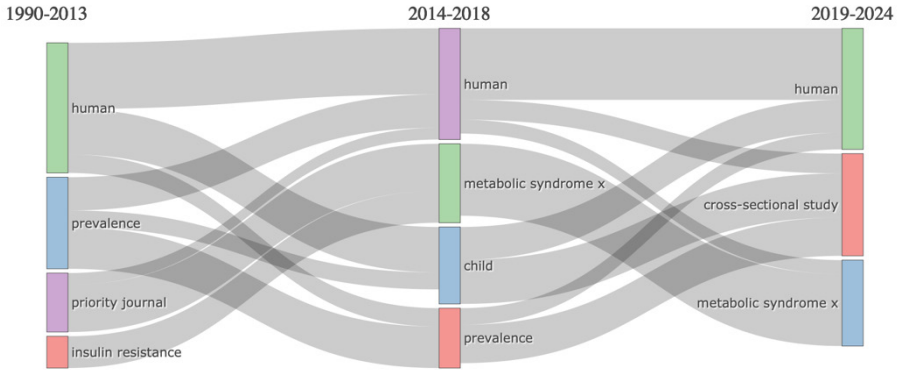


B

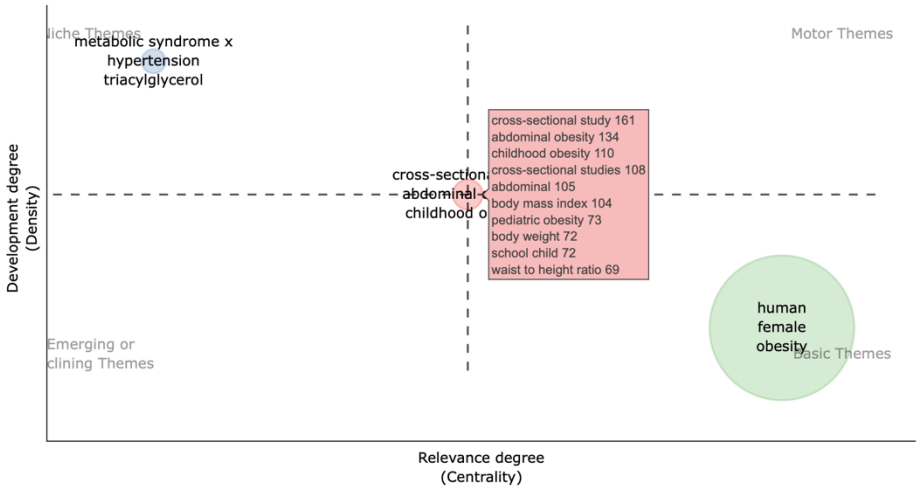


C

FIGURE 4. The Author's Keyword Co-Occurrence Network Analysis (A), The Overlay Visualization (B), The Density Visualization (C)



A



B

FIGURE 5. Thematic Evolution: 1990-2013; 2014-2018; 2019-2024 (A); Themes in 2019-2024 (B)

index, waist circumference, and waist-to-hip). Topics related to epidemiology and ethnicity emerged in this cluster. Along with limited articles from southeastern countries, future research from this region will be important to add information on ethnicity.

Cluster 3 revolves around the topic of metabolic syndrome, including cardiovascular disease, type 2 diabetes mellitus, dyslipidemia, and hypertension. The AAP clinical practice guidelines discuss the comorbidities of childhood obesity in detail (Skinner *et al.*, 2023). Cluster 4 had a more limited topic network. This cluster highlighted interesting topics related to physical activity and nutrition. Physical activity and diet are the most significant factors in the treatment of obesity in children and adolescents, although they are difficult to apply. AAP clinical practice guidelines signify pharmacotherapy and bariatric surgery to treat severe obesity.

Bibliometric analysis shows that in the context of obesity and/or central obesity, diagnosis is made through anthropometric measurements (body mass index, waist-to-height ratio, waist-to-hip ratio, waist circumference, and neck circumference), body fat assessment (abdominal obesity, adiposity), metabolic syndrome and its complications (insulin resistance, dyslipidemia, hypertension, cardiovascular, and polycystic ovary syndrome) was the most important known research results. Waist-to-hip ratio (cluster 2), waist-to-height ratio (cluster 1), lifestyle (cluster 1),

and dyslipidemia (cluster 3) should be selected as the future topics of interest to be further investigated in childhood obesity (**Fig. 4B**). These results comparable with the biblioshiny's result that concluded childhood obesity and abdominal obesity as the new interesting topics. Restricted terms illustrate the treatment of obesity and/or central obesity in children and adolescents.

Conclusion

A comprehensive review of central obesity in children and adolescents was conducted. The expanding publications largely came from the US, China, the UK, India, and suggesting that further research from other regions is needed. Future research is expected to focus on several important topics, including waist-to-hip ratio, waist-to-height ratio, lifestyle, and dyslipidemia. The treatment of obesity in children and adolescents is also a crucial topic to be studied in the future.

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