

DEMOGRAPHIC CHARACTERISTICS AND BODY MASS INDEX IN OBESE ADOLESCENTS

Karakteristik Demografi dan Indeks Massa Tubuh pada Remaja Obesitas

Nur Aisyah Widjaja^{1,2,3}, Rendi Aji Prihaningtyas^{1,2}, Meta Herdiana Hanindita^{1,2}, Roedi Irawan^{1,2}

¹Department of Child Health, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, nuril08@yahoo.com

²Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia, nuril08@yahoo.com

³Medical Doctoral Program Student at Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

Corresponding Author: Nur Aisyah Widjaja, nuril08@yahoo.com, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

ARTICLE INFO

Article History:

Received July, 8th, 2019

Revised form July, 26th, 2019

Accepted September, 27th, 2019

Published online September, 30th, 2019

Keywords:

obesity;
body mass index;
adolescence;
demography

Kata Kunci:

*obesitas;
indeks massa tubuh;
remaja;
demografi*

ABSTRACT

Background: The prevalence of adolescent obesity is increasing in Indonesia. Obesity can reduce the quality of life, especially as most obese adolescents remain obese after they become adult. In obese adolescents, the higher their IMT (intima-media thickness), the higher the risk of cardiovascular disease in adulthood. **Purpose:** The aim of this study is to analyse the correlation of demographic characteristics with BMI (body mass index) in adolescents with obesity. **Methods:** This study is a cross-sectional study on adolescents with obesity conducted in the Paediatric Nutrition and Metabolic Disease Clinic of Dr Soetomo General Hospital, Surabaya. The data on demographic characteristics, such as gender, number of siblings, paternal education, maternal education, and maternal occupation, were collected using the interview method. Data on anthropometry were collected to calculate BMI. Obesity is established if it is higher than the 95th percentile, based on CDC percentile of BMI, according to age and sex. Data were analysed using multiple regression. **Results:** A total of 59 obese adolescents, between 13 and 16 years old, were involved. As many as 49.20% of respondents had one sibling. As many as 52.50% of respondents had a father with a high school education and 44.10% of respondents had mothers with a high school education; 61% of respondents had working mothers. There was no correlation between BMI and demographic characteristics ($p > 0.05$), except for number of siblings ($p = 0.02$). **Conclusion:** In this study, the number of siblings was correlated with BMI. A study with a greater number of obese adolescents and with adolescents who have normal nutritional status is needed to fully assess the influence of demographic characteristics on BMI in obese adolescents.

©2019 Jurnal Berkala Epidemiologi. Published by Universitas Airlangga.

This is an open access article under CC-BY-SA license

(<https://creativecommons.org/licenses/by-sa/4.0/>)

ABSTRAK

Latar Belakang: Angka obesitas pada remaja semakin meningkat di Indonesia. Sebagian besar remaja obesitas tetap menjadi obesitas pada saat dewasa. Obesitas meningkatkan risiko penyakit

kardiovaskular dan menurunkan kualitas hidup. **Tujuan:** Penelitian ini bertujuan untuk menganalisis korelasi karakteristik demografi terhadap Indeks Massa Tubuh (IMT) pada remaja obesitas. **Metode:** Penelitian ini merupakan studi cross sectional pada remaja obesitas yang berkunjung ke Poli Nutrisi dan Penyakit Metabolik Anak RSUD Dr. Soetomo Surabaya. Variabel yang diteliti antara lain karakteristik demografi (jenis kelamin, jumlah saudara kandung, pendidikan ayah, pendidikan dan pekerjaan ibu) dan pengukuran antropometri (tinggi dan berat badan). Data karakteristik demografi didapatkan melalui wawancara. Obesitas didapatkan berdasarkan kurva CDC 2000 dengan Indeks Massa Tubuh/Umur (IMT/U) $>P_{95}$ menurut umur dan jenis kelamin. Data dianalisis dengan regresi ganda. **Hasil :** Total terdapat 59 remaja obesitas yang berusia 13-16 tahun terlibat pada penelitian ini. Sebanyak 49,20% responden memiliki satu saudara kandung. Sebanyak 52,50% responden memiliki ayah dengan pendidikan terakhir SMA. Sebanyak 44,10% responden memiliki ibu dengan pendidikan terakhir SMA, dan sebanyak 61% responden memiliki ibu yang bekerja. Tidak ada korelasi antara karakteristik demografi terhadap IMT pada remaja obesitas ($p>0,05$), kecuali jumlah saudara kandung ($p=0,02$). **Kesimpulan :** Terdapat korelasi antara jumlah saudara kandung terhadap IMT pada remaja obesitas. Studi lebih lanjut dengan jumlah responden yang lebih banyak dan responden kontrol yang memiliki status gizi normal dibutuhkan untuk menilai korelasi karakteristik demografi terhadap IMT pada remaja obesitas.

©2019 Jurnal Berkala Epidemiologi. Penerbit Universitas Airlangga.
Jurnal ini dapat diakses secara terbuka dan memiliki lisensi CC-BY-SA
(<https://creativecommons.org/licenses/by-sa/4.0/>)

INTRODUCTION

In obesity there is excess fat accumulation. Obesity is indicated by a body mass index (BMI) higher than the 95th percentile, based on CDC percentiles of BMI, according to age and sex (Kolotkin & Andersen, 2017).

Obesity remains a global problem with increasing prevalence at all ages, including among adolescents. Adolescence is a transition phase from childhood to adulthood in which some changes occur, such as physical changes and psychosocial development, that affect health-related behaviour. Awareness about obesity and the health effects caused by obesity is still low among adolescents (Alasmari, Al-Shehri, Aljuaid, Alzaidi, & Alswat, 2017).

The incidence of obesity in adolescents increased to 11.50% in 2011 in Indonesia (Rachmi, Li, & Alison Baur, 2017). In adolescents aged 12–19 years in Asian countries, the prevalence of obesity is 8.60% (Mazidi, Banach, & Kengne, 2018).

Obesity causes several complications, which in turn cause a decrease in the quality of life

(Kolotkin & Andersen, 2017). Most obese adolescents continue to suffer from obesity after they become adult (Simmonds et al., 2015).

The risk factor for cardiovascular disease in adulthood increases if the obesity occurs in childhood (Umer et al., 2017). Manifestation of cardiovascular disease due to obesity is acceleration of the atherosclerosis process, which causes strokes, myocardial infarction, and heart failure. Obesity can directly disrupt the function and structure of the cardiovascular system due to excess fat accumulation. Obesity also indirectly causes cardiovascular disorders due to metabolic syndrome, which arises as a result of obesity complications such as insulin resistance, hyperglycaemia, dyslipidaemia, and hypertension (Koliaki, Liatis, & Kokkinos, 2019).

BMI is currently used as a parameter of body weight and height to show the obesity level. BMI has some limitations, including it does not entirely show the body fat and cannot provide information about body mass (Nuttall, 2015). In childhood and adolescence until adulthood, BMI tends to remain constant (Simmonds et al., 2015).

BMI is associated with obesity-related complications and the risk of mortality (Klatsky, Zhang, Udaltsova, Li, & Tran, 2017). BMI during adolescence can be a predictor of cardiovascular disease in adulthood (Twig et al., 2016).

The success of conservative therapy for weight loss is still limited and influenced by age and sex (Gailite, Apela, Dzīvīte-Krišāne, & Gardovska, 2019). Preventing obesity is currently a step that is widely promoted in the community, especially among adolescents. The younger the age of the child, the greater the influence of obesity prevention programmes on BMI (Weihrauch-Blüher et al., 2018). Preventing obesity begins with early detection of the risk of obesity in a child and adolescent (Alasmari, Al-Shehri, Aljuaid, Alzaidi, & Alswat, 2017).

The two main factors that give rise to obesity are environmental and genetic. This paper focuses on the environmental factor. The environmental factor encompasses sociodemographic conditions associated with BMI in adolescents and adolescent behaviour related to health. It includes lifestyle, high socioeconomic conditions, and unsafe environment. One risk factor for obesity in Indonesia is high socioeconomic conditions (Rachmi et al., 2017). Living in an unsafe environment can increase BMI, because children and adolescents living in unsafe environments tend to limit physical activity outside the home and tend to have sedentary behaviour (An, Yang, Hoschke, Xue, & Wang, 2017). Sedentary behaviour such as watching television is associated with consumption of high-calorie foods. This causes obesity in adolescents (Avery, Anderson, & Mccullough, 2019).

Gender influences food selection and decisions to consume food (Cavazza, Guidetti, & Butera, 2015). Gender also influences physical activity in adolescence (Estrada, Sotelo, Valdes-Ramos, Murúa, & Manjarrez-Montes-de-Oca, 2017).

Another environmental factor that influences obesity is parents. Parental support, such as providing healthy food at home and encouraging children to consume healthy foods, reduce sedentary behaviour, and be more physically active, are examples of preventive steps that can improve BMI. Parental support is influenced by parents' work and education, but this relationship is not always the same in every country (Muthuri et al., 2016).

The purpose of this study is to analyse the correlation between BMI in obese adolescents and the following demographic characteristics: sex,

number of siblings, parental education, maternal education and maternal occupation.

METHODS

A cross-sectional study of obese adolescents was performed at the Paediatric Nutrition and Metabolic Disease Clinic in Dr Soetomo General Hospital, Surabaya. All obese adolescents involved in this study were recruited between July and October 2018.

Respondents who met the inclusion criteria were recruited. Inclusion criteria were obesity, aged 13–16 years, fluent in Bahasa Indonesia, biological parents who are still alive, living with family, and parental consent to participate in the study. Exclusion criteria were steroid intake in the six months before the study that could affect BMI, getting hormone therapy, consuming alcohol, smoking, suffering from endocrine disorders, and obesity due to other diseases.

Demographic characteristics analysed in this study were sex, number of children, paternal education, maternal education and maternal occupation. Data of respondent demographic characteristics were collected through direct interviews using data collection sheets.

The anthropometry measurements of respondents, including body height and weight, were done by trained health workers. Height measurement was performed using a portable stadiometer to the nearest 0.1 cm (Seca, Germany Ref. 224 1714009). Height measurements were carried out as follows: respondents were in an upright position and did not have bare feet or wear hats.

Weight measurement was performed using a digital scale to the nearest 0.1 kg (Seca, Germany Ref. 224 1714009) placed on a flat ground. Weight was measured without respondents wearing footwear or other accessories. BMI was calculated using the formula: weight (kilograms)/height squared (metre²). The results of BMI were plotted into a BMI curve based on CDC 2000 according to age and sex.

After the data were collected on the data collection sheet, they were processed and analysed statistically using the software. Variables of sex, number of siblings, parental education, maternal education, and maternal occupation were analysed using multiple regression with a significant $p < 0.05$.

This study was approved by the Ethics Committee of Dr Soetomo General Hospital, Surabaya (No. 0411/KEPK/VII/2018). Before the

study was conducted, parents were informed, and an informed consent form was filled in.

RESULTS

A total of 59 obese adolescents were recruited for this study. Respondents were aged between 13 and 16 years. The average BMI of respondents was $31.99 \pm 3.67 \text{ kg / m}^2$.

A total of 32 (54.2%) respondents were male. The majority of respondents had one sibling (49.20%) (Table 1).

Most respondents had fathers with a high school education (52.50%) and mothers with a high school education (44.10%). Most respondents had working mothers (61%) (Table 1).

Table 1
Characteristics of Respondents

Variabel	n	%
Sex		
Female	27	45,80
Male	32	54,20
Number of siblings		
None	15	25,40
One	29	49,20
Two	14	23,70
Three	1	1,70
Maternal Education		
Elementary School	4	6,80
Middle School	5	8,50
High School	25	44,10
Diploma	5	8,50
Bachelor	17	28,80
Uneducated	2	3,40
Maternal Occupation		
Unemployed	23	39,00
Employed	36	61,00
Paternal Education		
Elementary School	5	8,50
Middle School	3	5,10
High School	31	52,50
Diploma	4	6,80
Bachelor	15	25,40
Uneducated	1	1,70
Total	59	100,00

The statistical analysis test showed no correlation between sex, paternal education, maternal education, and maternal occupation and BMI in obese adolescents ($p > 0.05$). Only number of siblings correlated with BMI in obese adolescents ($p = 0.02$) (Table 2).

Table 2

Correlation between Sex, Number of Siblings, Paternal Education, Maternal Education, and Maternal Occupation and BMI in Respondents

	BMI	
	95% CI	<i>p</i>
Sex	-0,390-3,642	0,55
Number of Siblings	0,181-2,634	0,02
Paternal Education	-0,853-1,494	0,58
Maternal Education	-0,1040-0,445	0,42
Maternal Occupation	-0,545-3,274	0,15

DISCUSSION

Obesity complications are influenced by the duration of obesity. The younger a person suffers from obesity, the greater the complications, including cardiovascular disease and metabolic complications. This can cause the quality of life for obese individuals to be lower (Kolotkin & Andersen, 2017).

In obesity, there is chronic low-grade inflammation due to the imbalance of cytokines. Inflammatory processes that occur in obesity cause various complications, including cardiovascular disease (hypertension, stroke, dyslipidaemia, and heart failure), cancer, neurological diseases, respiratory disorders (such as asthma), digestive disorders, kidney disorders, fertility disorders, diabetes disorders, musculoskeletal disorders, and psychological disorders, which cause low quality of life (Kolotkin & Andersen, 2017). The complications that occur depend on the severity of the obesity (Twig et al., 2016).

Currently, children and adolescents are the target of obesity prevention and treatment programmes. Yet the level of awareness of obesity complications is insufficient among adolescents (Alasmari, Al-Shehri, Aljuaid, Alzaidi, & Alswat, 2017). Hence, an awareness-raising preventive programme is needed for adolescents throughout Asia, especially given that obese adolescents tend to remain obese when they become adult. Previous studies have shown that to lose weight in adulthood is more difficult than at a younger age (Mazidi, Banach, & Kengne, 2018; Simmonds et al., 2015).

As BMI shows nutritional status, such as obesity, and is also associated with mortality in obesity, the higher the BMI in adolescents, the greater the risk of cardiovascular and other complications in adulthood (Twig et al., 2016). Detection of factors associated with higher BMI in obesity is, therefore, one of the steps to prevent obesity in adolescence.

Sex

Sex affects the incidence of obesity. Mazidi, Banach, & Kengne (2018) found that the prevalence of obesity in male adolescents was higher than in female adolescents in Asian countries, stating the prevalence of obesity was 10.10% in male adolescents and 6.20% in female adolescents. This study is in line with that study, finding the incidence of obesity higher in male adolescents (54.20%) than in female adolescents (45.80%).

Sex affects the incidence of obesity in adolescents in several ways, including eating behaviour, food selection, physical activity, and perception of body size. Girls tend to consume healthier foods and pay attention to their weight compared with boys. More than a quarter of obese adolescents experience food control disorders (He, Cai, & Fan, 2019). Boys tend to be attracted to fatty foods and don't pay as much attention to their size. This causes more obesity in boys than girls (Juan et al., 2018).

However, other studies have shown that obesity is more common in girls than boys (Estrada, Sotelo, Valdes-Ramos, Murúa, & Manjarrez-Montes-de-Oca, 2017). This happens through the effect of sex on physical activity. Boys tend to have more physical activity than girls, and tend to do more moderate to heavy physical activity than girls (Butte et al., 2014).

The effect of sex on the incidence of obesity can be different in different studies because the existence of cultural differences can cause differences in the influence of sex on obesity. For example, the stigma of obesity in some societies can cause individuals to pay attention to their size in order to prevent obesity (Gordon, Walker, Gur, & Olien, 2018).

Number of Siblings

This study showed that number of siblings correlates with BMI in obese adolescents, which is not in line with a study by Bilić-Kirin et al (2014) that stated obesity was not influenced by the number of children in the family.

However, studies of obese children aged 0–5 years found a correlation between the number of siblings and the incidence of obesity. A meta-analysis study stated that the lower the number of siblings, the higher the risk of obesity (Meller et al., 2018). The risk of obesity in children born as the last child is higher than for children who do not have siblings. Children who have obese siblings also have a greater risk of becoming obese themselves (Hu, Ding, Zhen, Liu, & Wen, 2017).

Parents' preferences play a role in obesity. The last child gets priority nutrition in limited economic conditions, so it tends to become obese. The first and second children as older siblings tend to prioritise younger siblings, so the last child in the family tends to get more calorie intake. This condition can cause obesity in the last child (Hu, Ding, Zhen, Liu, & Wen, 2017).

Paternal and Maternal Education

Obesity is associated with low maternal education (Vázquez-Nava, Treviño-García-Manzo, Vázquez-Rodríguez, & Vázquez-Rodríguez, 2013). Having mothers with low education increases the risk of obesity (Ruiz et al., 2016).

Maternal education can affect the provision of breast milk and complementary foods associated with adiposity in children. Mothers with higher levels of education are less inclined to breastfeed their children compared to mothers with lower levels of education (Zhao, Zhao, Du, Binns, & Lee, 2017). Children who have mothers with a low educational level have more sedentary behaviour (Vázquez-Nava, Treviño-García-Manzo, Vázquez-Rodríguez, & Vázquez-Rodríguez, 2013). Another study stated there is a negative correlation between moderate to heavy physical activity carried out by children and the level of maternal education (Butte et al., 2014).

There was no correlation found between maternal education and BMI in obese adolescents. A previous study stated that the relationship between maternal education level and BMI can be different in every country (Muthuri et al., 2016).

This study had a different ethnic of respondents compared with the previous study. The cultural factor may influence mothers to breastfeed their babies, which will affect the risk of obesity (Zhao, Zhao, Du, Binns, & Lee, 2017). The higher the level of paternal education, in countries with high or low incomes, does not appear to influence the risk of obesity (Muthuri et al., 2016). In this study, paternal education level was not correlated with BMI in obese adolescents.

Previous studies stated that the correlation between paternal education level with BMI can be different in every country obesity (Muthuri et al., 2016). Cultural differences can influence the parents' education and risk of obesity. Mother's age and mother's obesity can influence the parent's education in obesity (Ruiz et al., 2016). The positive habits in the family can be protective factors for obesity (Ong, Ullah, Magarey, Miller, & Leslie, 2017).

Maternal Occupation

Children or adolescents who have mothers who work outside the home have higher risk of obesity. Maternal occupation affects sedentary behaviour and food consumption, which increases the risk of obesity. Working mothers have limited time at home, such as accompanying children to play, eat with children, and prepare healthy food. Working mothers have 12 minutes and 10 minutes less time to accompany children to play and eat. Hence, children tend to play alone, spend more time watching television, and consume unhealthy foods (Datar, Nicosia, & Shier, 2014).

Irregular working time is also associated with obesity. Working hours are positively correlated with consumption of unhealthy foods (Datar, Nicosia, & Shier, 2014). As much as 57% of parents choose to buy food that is ready for consumption because they have limited time (Hornung, Fulkerson, Friend, & Story, 2017).

In this study no correlation was found between maternal occupation and BMI in obese adolescents. The results of this study were different from previous studies, one of which found that obesity can be influenced by cultural differences and positive habits in the family. Positive habits in the family, such as regular eating, breakfast, healthy diets, and physical activity can also affect children's behaviour that is protective against obesity. Previous studies suggest that positive habits that have been developed in the family environment can be protective factors for obesity, such as consumption of vegetables and fruit at home by parents (Ong, Ullah, Magarey, Miller, & Leslie, 2017)

Research Limitations

This study has limitations. There was a limited number of respondents and no control respondents (respondents with normal nutritional status) were involved as a comparison group.

More respondents and a control group are needed to analyse the correlations of demographic characteristics with BMI in obese adolescents.

CONCLUSION

Number of siblings was correlated with BMI in obese adolescents. There was no correlation with sex, paternal education, maternal education, or maternal occupation in obese adolescents.

Further studies on obese adolescents with more respondents and control respondents who have normal nutritional status are needed to assess

the correlation of demographic characteristics with BMI in obese adolescents.

ACKNOWLEDGMENT

The authors thank Dr Soetomo General Hospital, Surabaya, which funded this study, nurses at the Paediatric Clinic of Dr Soetomo General Hospital, and all respondents who participated in this study.

REFERENCES

- Alasmari, H. D., Al-Shehri, A. D., Aljuaid, T. A., Alzaidi, B. A., & Alswat, K. A. (2017). Relationship between body mass index and obesity awareness in school students. *Journal of Clinical Medicine Research*, 9(6), 520–524. <https://doi.org/10.14740/jocmr2987w>
- An, R., Yang, Y., Hoschke, A., Xue, H., & Wang, Y. (2017). Influence of neighborhood safety on childhood obesity: a systematic review and meta-analysis of longitudinal studies. *HHS Public Access*, 18(11), 1289–1309. <https://doi.org/10.1007/s10995-015-1800-4>. Alcohol
- Avery, A., Anderson, C., & Mccullough, F. (2019). Associations between children's diet quality and watching television during meal or snack consumption: a systematic review. *Maternal and Child Nutrition*, 13(4), 1–19. <https://doi.org/10.1111/mcn.12428>
- Bilić-Kirin, V., Burazin, J., Buljan, V., Bilić-Kirin, V., Gmajnić, R., Miličić, V., & Ivanko, M. (2014). Association between socioeconomic status and obesity in children. *Collegium Antropologicum*, 38(2), 553–558.
- Butte, N. F., Gregorich, S. E., Tschann, J. M., Penilla, C., Pasch, L. A., De Groat, C. L., ... Martinez, S. M. (2014). Longitudinal effects of parental, child and neighborhood factors on moderate-vigorous physical activity and sedentary time in Latino children. *International Journal of Behavioral Nutrition and Physical Activity*, 11(1), 1–12. <https://doi.org/10.1186/s12966-014-0108-x>
- Cavazza, N., Guidetti, M., & Butera, F. (2015). Ingredients of gender-based stereotypes about food. Indirect influence of food type, portion size and presentation on gendered intentions to eat. *Appetite*, 91, 266–272. <https://doi.org/10.1016/j.appet.2015.04.068>
- Datar, A., Nicosia, N., & Shier, V. (2014). Maternal work and children's diet, activity, and obesity. *Social Science and Medicine*,

- 107, 196–204.
<https://doi.org/10.1016/j.socscimed.2013.12.022>
- Estrada, F. de M. C., Sotelo, P. T., Valdes-Ramos, R., Murúa, J. A. H., & Manjarrez-Montes-de-Oca, R. (2017). Overweight or obesity, gender, and age influence on high school students of the city of Toluca's Physical Fitness. *BioMed Research International*, 2017(9546738), 1–11.
<https://doi.org/10.1155/2017/9546738>
- Gailite, J., Apela, D., Dzīvīte-Krišāne, I., & Gardovska, D. (2019). Short-term predictors for weight correction success of the first paediatric weight correction programme in children's clinical university hospital in Riga. *Medicina*, 55(75), 1–8.
<https://doi.org/10.3390/medicina55030075>
- Gordon, H. L., Walker, L. S., Gur, S., & Olien, J. L. (2018). Obesity and gender as status beliefs. *Social Science Research*, 71, 11–18.
<https://doi.org/10.1016/j.ssresearch.2017.12.004>
- He, J., Cai, Z., & Fan, X. (2019). Prevalence of binge and loss of control eating among children and adolescents with overweight and obesity: an exploratory meta-analysis. *International Journal of Eating Disorders*, 50(2), 18–20.
- Horning, M. L., Fulkerson, J. A., Friend, S. E., & Story, M. (2017). Reasons parents buy prepackaged, processed meals: it is more complicated than “i don't have time.” *Journal of Nutrition Education and Behavior*, 49(1), 60–66.
<https://doi.org/10.1016/j.jneb.2016.08.012>
- Hu, J., Ding, N., Zhen, S., Liu, Y., & Wen, D. (2017). Who is more likely to be obese or overweight among siblings? a nationally representative study in rural China. *PLoS ONE*, 12(11), 1–10.
<https://doi.org/10.1371/journal.pone.0187693>
- Juan, Z., Yi, Z., Qi, F. X., Rong, L. W., Bin, L. Y., Thomas, A.-B., ... Ming, S. X. (2018). Gender differences in the prevalence of overweight and obesity, associated behaviors, and weight-related perceptions in a National Survey of Primary School Children in China. *Biomedical and Environmental Sciences*, 31(1), 1–11.
<https://doi.org/10.3967/bes2018.001>
- Klatsky, A. L., Zhang, J., Udaltsova, N., Li, Y., & Tran, H. N. (2017). Body mass index and mortality in a very large cohort: is it really healthier to be overweight? *The Permanente Journal*, 21(16), 142–149.
<https://doi.org/10.7812/TPP/16-142>
- Koliaki, C., Liatis, S., & Kokkinos, A. (2019). Obesity and cardiovascular disease: revisiting an old relationship. *Metabolism: Clinical and Experimental*, 92, 98–107.
<https://doi.org/10.1016/j.metabol.2018.10.011>
- Kolotkin, R. L., & Andersen, J. R. (2017). A systematic review of reviews: exploring the relationship between obesity, weight loss and health-related quality of life. *Clinical Obesity*, 7(5), 273–289.
<https://doi.org/10.1111/cob.12203>
- Mazidi, M., Banach, M., & Kengne, A. P. (2018). Prevalence of childhood and adolescent overweight and obesity in Asian countries: a systematic review and meta-analysis. *Archives of Medical Science*, 14(6), 1185–1203.
<https://doi.org/10.5114/aoms.2018.79001>
- Meller, F. O., de Mola, C. L., Assunção, M. C. F., Schäfer, A. A., Dahly, D. L., & Barros, F. C. (2018). Birth order and number of siblings and their association with overweight and obesity: a systematic review and meta-analysis. *Nutrition Reviews*, 76(2), 117–124.
<https://doi.org/10.1093/nutrit/nux060>
- Muthuri, S. K., Onyvera, V. O., Tremblay, M. S., Broyles, S. T., Chaput, J. P., Fogelholm, M., ... Pietrobelli, A. (2016). Relationships between parental education and overweight with childhood overweight and physical activity in 9-11 year old children: Results from a 12-country study. *PLoS ONE*, 11(8), 1–14.
<https://doi.org/10.1371/journal.pone.0147746>
- Nuttall, F. Q. (2015). Body mass index: obesity, BMI, and health: a critical review. *Nutrition Today*, 50(3), 117–128.
<https://doi.org/10.1097/NT.0000000000000092>
- Ong, J. X., Ullah, S., Magarey, A., Miller, J., & Leslie, E. (2017). Relationship between the home environment and fruit and vegetable consumption in children aged 6-12 years: a systematic review. *Public Health Nutrition*, 20(3), 464–480.
<https://doi.org/10.1017/S1368980016002883>
- Rachmi, C. N., Li, M., & Alison Baur, L. (2017). Overweight and obesity in Indonesia: prevalence and risk factors—a literature review. *Public Health*, 147, 20–29.
<https://doi.org/10.1016/j.puhe.2017.02.002>
- Ruiz, M., Goldblatt, P., Morrison, J., Porta, D.,

- Forastiere, F., Hryhorczuk, D., ... Pikhart, H. (2016). Impact of low maternal education on early childhood overweight and obesity in Europe. *Paediatric and Perinatal Epidemiology*, 30(3), 274–284. <https://doi.org/10.1111/ppe.12285>
- Simmonds, M., Burch, J., Llewellyn, A., Griffiths, C., Yang, H., Owen, C., ... Woolacott, N. (2015). The use of measures of obesity in childhood for predicting obesity and the development of obesity-related diseases in adulthood: a systematic review and meta-analysis. *Health Technology Assessment*, 19(43), 5–335. <https://doi.org/10.3310/hta19430>
- Twig, G., Yaniv, G., Levine, H., Leiba, A., Goldberger, N., Derazne, E., ... Kark, J. D. (2016). Body-mass index in 2.3 million adolescents and cardiovascular death in adulthood. *New England Journal of Medicine*, 374(25), 2430–2440. <https://doi.org/10.1056/NEJMoa1503840>
- Umer, A., Kelley, G. A., Cottrell, L. E., Giacobbi, P., Innes, K. E., & Lilly, C. L. (2017). Childhood obesity and adult cardiovascular disease risk factors: a systematic review with meta-analysis. *BMC Public Health*, 17(1), 1–24. <https://doi.org/10.1186/s12889-017-4691-z>
- Vázquez-Nava, F., Treviño-García-Manzo, N., Vázquez-Rodríguez, C. F., & Vázquez-Rodríguez, E. M. (2013). Association between family structure, maternal education level, and maternal employment with sedentary lifestyle in primary school-age children. *Jornal de Pediatria*, 89(2), 145–150. <https://doi.org/10.1016/j.jped.2013.03.009>
- Weihrauch-Blüher, S., Kromeyer-Hauschild, K., Graf, C., Widhalm, K., Korsten-Reck, U., Jödicke, B., ... Wiegand, S. (2018). Current guidelines for obesity prevention in childhood and adolescence. *Obesity Facts*, 11(3), 263–276. <https://doi.org/10.1159/000486512>
- Zhao, J., Zhao, Y., Du, M., Binns, C. W., & Lee, A. H. (2017). Maternal education and breastfeeding practices in China: a systematic review and meta-analysis. *Midwifery*, 50, 62–71. <https://doi.org/10.1016/j.midw.2017.03.011>