






Body Fat Composition Related to Fatty Snack Habit Consumption of Office Workers in Urban Area

Rosyanne Kushargina^{1*}, Tria Astika Endah Permatasari¹, Andi Eka Yuniyanto²

¹Nutrition Program, Faculty of Health and Medicine, Universitas Muhammadiyah Jakarta, South Tangerang, Indonesia;

²Departement of Nutrition, Faculty of Health Science, Siliwangi University, Tasikmalaya, Indonesia

Abstract

Edited by: Sasho Stoileski

Citation: Kushargina R, Permatasari TAE, Yuniyanto AE. Body Fat Composition Related to Fatty Snack Habit Consumption of Office Workers in Urban Area. Open Access Maced J Med Sci. 2022 Mar 15; 10(E):365-370. <https://doi.org/10.3889/oamjms.2022.7280>

Keywords: Body fat; Fatty snacks; Visceral fat

Corresponding author: Rosyanne Kushargina, Nutrition Program, Faculty of Health and Medicine, Universitas Muhammadiyah Jakarta, Indonesia.

E-mail: rosyanne.kushargina@umj.ac.id

Received: 12-Sep-2021

Revised: 15-Feb-2022

Accepted: 05-Mar-2022

Copyright: © 2022 Rosyanne Kushargina,

Tria Astika Endah Permatasari, Andi Eka Yuniyanto

Funding: This research did not receive any financial support

Competing Interests: The authors have declared that no competing interests exist

Open Access: This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

BACKGROUND: The fatty snack cooked with a deep-fried process is a snack that is often consumed by Indonesian people. The high oil content in fatty snacks results in the risk of obesity.

AIM: The purpose of this study was to analyze the consumption habits of fatty snacks with body fat composition of office workers in urban area.

METHODS: This research design uses a cross-sectional study with a purposive sampling method consisting of men and women with a total of 112 respondents. Food consumption data were obtained using semi-quantitative FFQ, while body fat composition used Bio Electrical Impedance Analysis. The relationship between fatty snacks consumption and body fat was analyzed using the Chi-square test, while the differences between the two groups based on gender were analyzed using the independent sample t-test.

RESULTS: There was a significant relationship between age and body fat ($p = 0.005$) and visceral fat ($p = 0.004$). Nutritional status had a significant relationship with body fat ($p = 0.003$) and visceral fat ($p = 0.000$). Fatty snacks consumption habits were associated with body fat ($p = 0.008$), while not visceral fat ($p > 0.05$). There was no significant difference ($p > 0.05$) between men and women based on body and visceral fat composition, nutritional status, and frequency of consumption of fatty snacks.

CONCLUSION: Consumption of fatty snacks more than once per day is closely related to body fat.

Introduction

Street food becomes an inseparable part of the Indonesian diet. Many types of street food that most famous in Indonesia. One of them is fatty snacks. Fatty snacks are snacks that cooked with deep-fried process. They are very popular because of their unique characteristics, tasty, and crunchy. Deep frying is a very old cooked method and was used much centuries-long time ago [1], and now this method is famous in the world including in Indonesia. Frying may make food tastier and people more loved it [2], [3]. Unfortunately, besides delicious taste, a high frequency of fatty snacks consumption increased total cholesterol and triglycerides in the blood [4] and have an impact on a high risk of obesity and many non-communicable disease (NCDs). Evidence from a previous study showed that excessive consumption of energy-dense foods high in fat, particularly saturated fat, like fatty snacks can lead to weight gain, obesity, and may increase the risk of NCDs [5]. Dietary fats play an important role in the development of cardiovascular diseases. Fatty snacks have high saturated fat, so (World Health Organization) WHO recommends limiting consumption of saturated and trans fats from it [6].

According to the Basic Health Research, data from the Ministry of Health shown that Indonesian people consume fried foods ≥ 1 time/day with the national average that is 40.7% [7]. This number is expected to increase. In 2017, World Food Program (WFP) observed the eating habits of the Indonesian people. As many as, 53% of subjects like fried foods and choose to consume them as snacks [8]. Fatty snacks are preferred by various age groups, starting from pregnant women where food consumption in this critical period determines nutritional and health status in the next period. Furthermore, this food is favored by various other age groups that include children, adults, and the elderly [9]. There is a positive association between age and fried consumption habits [10]. This is in line with the increase in obesity. The prevalence of obesity at ≥ 15 years old increased from 18.8% in 2007 to 26.6% in 2013 and 31% in 2018 [7]. Obesity can occur in all age categories, many studies focus on obesity in adolescents.

Although obesity is more vulnerable in adults with low physical activity, such as office workers, office workers have a high risk of obesity. Therefore, this study aimed to the analyzed relationship between fatty snack consumption on body fat composition including body fat and visceral fat among office workers.

Methods

Time and study design

This study using a cross-sectional design. Ethical clearance is obtained from the Ethics Committee of the Faculty of Medicine and Health University of Muhammadiyah Jakarta (No. 046/PE/KE/FKK-UMJ/III/2018). The study was conducted for 4 months, in April–August 2018.

Setting area

The location of this research is at Lebak Bulus. Lebak Bulus is located in South of Jakarta. This area was selected using purposive sampling and was chosen because it is representative enough to represent office workers. This location is strategic. It is an urban area close to the capital city of Indonesia, namely, Jakarta. The distance between Lebak Bulus from Jakarta is 18.1 km with a travel time of approximately 30 min by car and 15 min with Jakarta's Mass Rapid Transit (MRT). Not only easy access to transportation, access to food including snacks is quite high, especially street foods. The most of the street food in urban area in Indonesia belong to the fast-food category and are processed using deep-frying techniques [11].

Subjects

The target population in this study were office workers from Lebak Bulus, South of Jakarta. Subjects aged 20–55 years and have worked full time for at least 1 year. Not allowed for pregnant women and employees who have serious health problems such as severe anemia and other complications of disease to be the subject of this study. There were 112 subjects selected using the purposive sampling method according to the inclusion and exclusion criteria. All subjects provided written informed consent after receiving an explanation of the purpose and protocol of the study.

Data collection procedure and analysis

Each subject was asked to fill out a self-data questionnaire, including fried food habits and exercise habits. Respondent characteristics are presented in Table 1. Nutritional status was measured by anthropometric method (kg/m^2), body weight was measured using SECA® digital scales (accuracy 0.1 kg) and height using microtoise (accuracy of 0.01 cm). Consumption of fried foods is measured using a semi Food Frequency Questionnaire (FFQ) [12].

Body fat composition in this study described the percentage of body fat and visceral fat [13]. Measurements using Bioimpedance Analysis (BIA-Omron®). Body fat percentage results interpreted

Table 1: Respondent characteristic (%)

Variable	Categorized	n (n = 112)	%
Sex	Man	58	51.8
	Women	54	48.2
Age (Years)	Men		
	20–40	28	48.3
	41–65	30	51.7
	Women		
	20–40	36	66.7
	41–65	18	33.3
Education	≤High School	34	30.4
	>School	78	69.6
Nutritional Status	Normal	43	38.4
	Abnormal*	69	61.6
Frequency of Fatty Snacks Consume	Often (>1 time/day)	59	52.7
	Rare (1–2 time/week)	53	47.3
Body Fat (%) (Mean: 30.3% ± 7.97)	Normal	17	15.2
	High	95	84.8
	Visceral Fat (%) (Mean : 10.41% ± 7.58)	Normal	55
	High	57	50.9
Sport Habits	Yes	85	75.9
	No	27	24.1

*Underweight, overweight, obese

based on National Institute of Health (NIH)/WHO guideline graded as normal and high. Visceral fat results were graded as normal and high based on Omron manual [14].

SPSS version 24.0 (IBM Statistic) was used for statistical analysis. Data are presented in categorical data and means ± standard deviation for a percentage of body fat and visceral fat. Chi-square was used to analyze the relationship between independent variables (age, sex, education, nutritional status, sports habits, and frequency of fatty snack consumption) with the dependent variable (body fat and visceral fat percentage). Differences based on gender for variable body fat percentage, visceral fat, nutritional status, and fried consumption were analyzed using the Independent Sample T-test.

Results

Table 2 shows the respondent characteristic according to the body fat. Percentage of body fat categorized by normal (men: 10–20% and woman: 25–30%) and high (men: 20–25% and

Table 2: Respondent characteristic according to the body fat

Variable	Composition of body fat				
	% Body fat		% Visceral fat		
	Normal n (%)	High n (%)	Normal n (%)	High n (%)	
Age	20–40	15 (88.2)	49 (51.6)	39 (70.9)	25 (43.9)
	41–65	2 (11.8)	46 (48.4)	16 (29.1)	32 (56.1)
Gender	Men	9 (52.9)	49 (51.6)	24 (43.6)	34 (59.6)
	Women	8 (57.1)	46 (48.4)	31 (56.4)	23 (40.4)
Education	≤High School	14 (29.5)	20 (35.1)	36 (65.5)	7 (12.3)
	>High School	41 (74.5)	37 (64.9)	19 (34.5)	50 (87.7)
Nutritional Status	Normal	12 (70.6)	31 (38.3)	36 (65.5)	7 (12.3)
	Abnormal*	5 (29.4)	50 (61.7)	19 (34.5)	50 (87.7)
Sport Habits	Yes	43 (78.2)	42 (73.7)	15 (88.2)	70 (73.7)
	No	12 (21.8)	15 (26.3)	2 (11.8)	25 (26.3)
Frequency of Fatty Snack Consume	Often (>1 time/day)	3 (17.6)	50 (52.6)	23 (41.8)	30 (52.6)
	Rare (1–2 times/week)	14 (82.4)	45 (47.4)	32 (58.5)	27 (47.4)

*Underweight, overweight, obese.

woman:30–35%), nor visceral fat, normal (0.5–9.5%) and high (10.0–14.5%).

Body fat

The highest percentage of body fat in the normal category is seen on age 20–40 years (88%), as well as the highest percentage of body fat in the category (51.6%) in that age group. Based on gender, 57.1% of women have normal body fat, and respectively, men are dominant in high body fat (51.6%). Percentage of normal body fat (74.5%) and high (64.9%) was found in subjects with education >high school.

Subjects with normal nutritional status had a normal body fat percentage (70.6%), as well as, subjects with abnormal nutritional status also had a percent of body fat over normal or included in the high category (61.7%). Percent of normal body fat (78.2%) and high (73.7%) are found in subjects who have sports habits. There is a large percentage of normal body fat in subjects who rarely consume fried foods (82.4%), in line with this, a high percentage of body fat is found in subjects who often consume fried foods (52.6%).

Visceral fat

The highest percentage of visceral fat in the normal category is seen at age 20–40 years (70.9%), while the highest category of visceral fat percentage occurs at the 41–65 years (56.1%). Based on gender, the most normal category of visceral fat is found in women (56.4%), while the majority of men (59.6%) have a percent of visceral fat in the high category. Normal percentages of visceral fat (65.5%) were found in subjects whose education level is ≤ high school, while high visceral fat (87.7%) was found in the group of subjects with education that is more than high school. Subjects with normal nutritional status have normal percentages of visceral fat (65.5%), as well as, subjects with abnormal nutritional status also have a percentage of visceral fat over normal or are included in the high category (87.7%). Percentages of normal (88.2%) and high visceral fat (73.7%) are found in subjects who have sports habits. The normal percentage of visceral fat is found in subjects who rarely consume fried foods (58.5%), in line with this, a high percentage of visceral fat is found in subjects who often consume fried foods (52.6%).

Relationship analysis

Relationship of respondent characteristic with body fat and visceral fat is shown in Table 3.

There is a positive relationship between the age of subjects with the percentage of body fat ($p = 0.005$ and OR: 7.04) and visceral fat ($p = 0.004$ and OR: 3.12). Nutritional status was significantly related to

Table 3: Relationship of respondent characteristic with body fat and visceral fat

Composition of body fat	% Body fat		% Visceral fat	
	P	OR (CI)	p	OR (CI)
Age	0.005	7.04 (1.53–32.49)	0.004	3.12 (1.43–6.83)
Sex	0.918	-	0.090	-
Education	0.292	-	0.268	-
Nutritional status	0.003	4.95 (1.60–15.31)	0.000	13.53 (5.15–35.58)
Sport habit	0.196	-	0.578	-
Frequency of fatty snack consume	0.008	5.19 (1.40–19.22)	0.252	-

the percentage of body fat ($p = 0.003$ and OR: 4.96) and visceral fat ($p = 0.000$ and OR: 13.54). The frequency of fatty snack consumption has a positive relationship with the percentage of body fat ($p = 0.008$ and OR = 5.16), nor of visceral fat ($p > 0.05$).

Different analysis

The results of the Independent Sample T-test (Table 4) showed that body fat and visceral composition, nutritional status, and frequency of fatty snack consumption were not significantly different ($p > 0.05$) between men and women.

Table 4: Independent t-test for dependent variable with gender

Variable	Men		Women		p
	Mean	SD	Mean	SD	
% Body fat	26.2	8.2	34.6	4.9	0.132
% Visceral fat	11.6	9.0	9.2	5.4	0.274
BMI	28.7	26.5	27.1	4.6	0.197
Fat consumption	20.0	21.5	20.2	29.4	0.513

Discussion

This study analyzed the relationship between the frequency of fried consumption and body composition. Body composition is defined as the relative proportion of fat tissue and fat-free tissue in the body. Body composition consists of four main components, namely, total body fat tissue, fat-free tissue (fat-free mass), bone mineral (bone mineral), and body fluids (body water). The two most commonly measured components of body composition are total body fat tissue and fat-free tissue. Body composition in aging is characterized by an increase in fat mass and decreases in lean tissues, including skeletal muscle mass which in older adults is related to reduced muscle strength and functional capability, as well as greater morbidity and mortality [15]. In this study, the body composition analyzed is body fat and visceral fat. Body fat and visceral fat in this study were measured using Bioimpedance (BIA). BIA is a commonly used method for body composition assessments in clinical practice and research studies. It is quick and simple [16].

This study shows that based on gender, dominant women have normal body fat (57.1%) and

dominant men in high body fat (51.6%). The most normal category of visceral fat is found in women (56.4%), while the majority of men (59.6%) have a percent of visceral fat in the high category. This result is not following the research previously conducted by O'Connor *et al.* [17]. In this study, female subjects had body fat that was higher than male subjects. This is because women reported higher snacking frequency than men.

Percentage of normal body fat (74.5%) and high (64.9%) was found in subjects with education more than in high school. However, normal percentages of visceral fat (65.5%) were found in subjects whose level of education is less than high school, while high visceral fat (87.7%) was found in the group of subjects with education more than high school. This result is contrary to the results of the research by O'Connor *et al.* which shows that higher snacking frequency was associated with shorter education duration [17]. So that subjects who have high body fat and visceral fat are subjects with shorter duration education but in this study, subjects with higher education duration have a normal and high body and visceral fat.

Subjects with normal nutritional status had normal body fat percent (70.6%), as well as, subjects with abnormal nutritional status also had a percent of body fat over normal or were included in the high category (61.7%) same with visceral fat. Subjects with normal nutritional status have normal percentages of visceral fat (65.5%), as well as, subjects with abnormal nutritional status also have a percentage of visceral fat over normal or included in the category (87.7%). Table 3 shows that nutritional status was significantly related to the percentage of body fat ($p = 0.003$ and OR:4.96) and visceral fat ($p = 0.000$; OR:13.54). These results are in line with the previous studies that nutritional status is directly proportional to the percentage of body fat [17], [18], [19], [20]. There is a positive relationship between the age of subjects with the percentage of body fat ($p = 0.005$ and OR: 7.04) and visceral fat ($p = 0.004$ and OR: 3.12). The composition of body fat tends to increase as well as higher age both in men and women.

Subjects who rarely consume fried foods (82.4%) have normal body fat, in line with this, a high category of body fat is found in subjects who often consume fried foods (52.6%). The normal percentage of visceral fat is found in those who rarely consume fried foods (58.5%) in line with this, a high percentage of visceral fat is found in subjects who often consume fried foods (52.6%). The frequency of fatty snack consumption has a positive relationship with only the percentage of body fat ($p = 0.008$; OR = 5.16), nor visceral fat. Body fat is the jiggly fat right underneath the skin. Body fat is additionally found in several zones of the body – back, butt, arms, legs, and so on. Visceral fat, on the other hand, is put away basically in our guts and it is the fat put away profound inside the body. Visceral fat encompasses the imperative organs such as the

stomach, kidneys, liver, and digestion tracts. There is solid proof that subcutaneous fat at a lower level may be sound for people and ensure against certain illnesses. Visceral fat, be that as it may, influences organ work and is changed over into cholesterol by the liver which is at that point carried through the heart and arteries. Visceral fat may be a major contributing calculate for conditions such as affront resistance, diabetes, stroke, and heart infection [21]. In this research, consumption of fried foods will increase body fat. This result is in line with Nurwanti *et al.* research which shows that unhealthy foods increased the obesity risk [19]. The increase in visceral fat is influenced by the consumption of fat from animal sources or meat [22]. It is suspected that there is no relationship between the consumption of fried foods and the percentage of visceral fat in this study because the fat consumed comes from vegetable origin, namely, palm oil. Moreover, consumption of fatty and processed meats and consumption of cereals proved to be potentiating predictors for visceral fat.

The results of the Independent Sample T-test (Table 4) showed that body fat and visceral composition, nutritional status, and frequency of consumption were not significantly different ($p > 0.05$) between men and women. Body composition differs between men and women. Men have more lean mass and women have more fat mass than men. Men are more likely to accumulate adipose tissue around the trunk and abdomen, whereas women usually accumulate adipose tissue around the hips and thighs [22]. For body mass index (BMI), women with the same BMI as men typically present with 10% higher body fat [23]. Women are characterized by higher percent body fat. Other research showed that women are characterized by lower intra-abdominal/visceral fat mass [24], [25], [26]. However, the difference in visceral fat mass is diminished and not consistently seen in older age groups [24], [25], [26], [27], [28], [29].

Conclusion

This research represents that fatty snack consumption more than 1 time/day was related to body fat composition of office workers in urban area. Many factors affect body composition, this study is not collecting physical activity data and only collecting snack consumption. Overall consumption can be collected using recall methods or other relevant methods.

References

1. Sánchez-Muniz FJ. Oils and fats: Changes due to culinary and industrial processes. *Int J Vitam Nutr Res.* 2006;76(4):230-7.

- <http://doi.org/10.1024/0300-9831.76.4.230>
PMid:17243087
2. Asokapandian S, Swamy GJ, Hajjul H. Deep fat frying of foods: A critical review on process and product parameters. *Crit Rev Food Sci Nutr.* 2019;60(20):3400-13. <http://doi.org/10.1080/10408398.2019.1688761>
PMid:31729249
 3. Oke EK, Idowu MA, Sobukola OP, Adeyeye SA, Akinsola AO. Frying of food: A critical review. *J Culin Sci Technol.* 2018;16(2):107-127. <https://doi.org/10.1080/15428052.2017.1333936>
 4. Kushargina R, Rimbawan R, Setiawan B, Rohdiana D. The decreasing activity of white tea and green tea on smokers lipids profile. *Indones J Tea Cinchona Res.* 2015;18(1):38. <https://doi.org/10.22302/pptk.jur.jptk.v18i1.68>
 5. Gadiraju TV, Patel Y, Gaziano JM, Djoussé L. Fried food consumption and cardiovascular health: A review of current evidence. *Nutrients.* 2015;7(10):8424-30. <https://doi.org/10.3390/nu7105404>
PMid:26457715
 6. Nishida C, Uauy R, Kumanyika S, Shetty P. The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases: Process, product and policy implications. *Public Health Nutr.* 2004;7(1A):245-50. <https://doi.org/10.1079/phn2003592>
PMid:14972063
 7. Kementrian Kesehatan RI. Riset Kesehatan Dasar Indonesia. Badan Penelit. dan Pengemb. Kesehat. Indonesia: Kementrian Kesehatan RI; 2018.
 8. Siswanto S, Permaesih D, Lamid A, Prihatini S, Rosmalina Y, Hermina H, Puspitasari DS, et al. Diet Total Study: Survey of Individual Food Consumption Indonesia 2014. Indonesia: Ministry of Health Republic of Indonesia; 2014.
 9. Permatasari TA, Rizqiya F, Kusumaningati W, Suryaalamah II, Hermiwayoeni Z. The effect of nutrition and reproductive health education of pregnant women in Indonesia using quasi experimental study. *BMC Pregnancy Childbirth.* 2021;21:1-15.
 10. Samohýl M, Hirošová K, Vondrová D, Argalášová L, Kachútová I, Jurkovičová J. Associations between cardiometabolic and behavioral risk factors and cardiovascular diseases. *Lek Obz.* 2019;314:355-60.
 11. Yulia C, Nikamawati EE, Widiaty I. Preliminary study in developing traditional street foods as nutrition education media for Indonesia youth. *Innov Vocat Technol Educ.* 2017;13:6256. <https://doi.org/10.17509/invotec.v13i1.6256>
 12. Sudikno S, Syarif H, Dwiriani CM, Riyadi H, Pradono J. Obesity risk factors among 25-65 years old adults in Bogor city, Indonesia: A prospective cohort study. *J Gizi dan Pangan.* 2018;13:55-62.
 13. Wells JC, Fewtrell MS. Measuring body composition. *Arch Dis Child.* 2006;91(7):612-7. <https://doi.org/10.1136/adc.2005.085522>
PMid:16790722
 14. Kitchlew DR, Khan Chachar DA, Latif S. Body mass index; visceral fat and total body fat distribution and its relation to body mass index in clinical setting using bio-impedance body composition monitor. *Prof Med J.* 2017;24(2):326-34.
 15. Achamrah N, Colange G, Delay J, Rimbart A, Folope V, Petit A, et al. Comparison of body composition assessment by DXA and BIA according to the body mass index: A retrospective study on 3655 measures. *PLoS One.* 2018;13(7):e0200465. <https://doi.org/10.1371/journal.pone.0200465>
PMid:30001381
 16. Lemos T, Gallagher D. Current body composition measurement techniques. *Curr Opin Endocrinol Diabetes Obes.* 2017;24(5):310-4. <https://doi.org/10.1097/MED.0000000000000360>
PMid:28696961
 17. O'Connor L, Brage S, Griffin SJ, Wareham NJ, Forouhi NG. The cross-sectional association between snacking behaviour and measures of adiposity: The Fenland study, uK. *Br J Nutr.* 2015;114(8):1286-93. <https://doi.org/10.1017/S000711451500269X>
PMid:26343512
 18. Hooper L, Abdelhamid A, Moore HJ, Douthwaite W, Skeaff CM, Summerbell CD. Effect of reducing total fat intake on body weight: Systematic review and meta-analysis of randomised controlled trials and cohort studies. *BMJ.* 2013;345:e7666.
 19. Nurwanti E, Uddin M, Chang JS, Hadi H, Syed-Abdul S, Su EC, et al. Roles of sedentary behaviors and unhealthy foods in increasing the obesity risk in adult men and women: A cross-sectional national study. *Nutrients.* 2018;10(6):704. <https://doi.org/10.3390/nu10060704>
PMid:29857537
 20. Cameron N, Godino J, Nichols JF, Wing D, Hill L, Patrick K. Associations between physical activity and BMI, body fatness, and visceral adiposity in overweight or obese Latino and non-Latino adults. *Int J Obes.* 2017;41(6):873-7. <https://doi.org/10.1038/ijo.2017.49>
PMid:28220040
 21. Elffers TW, De Mutsert R, Lamb HJ, De Roos A, Van Dijk KW, Rosendaal FR, et al. Body fat distribution, in particular visceral fat, is associated with cardiometabolic risk factors in obese women. *PLoS One.* 2017;12(9):e0185403. <https://doi.org/10.1371/journal.pone.0185403>
PMid:28957363
 22. Bredella MA. Sex Differences in Body Composition. In: Mauvais-Jarvis F, editor. *Sex and Gender Factors Affecting Metabolic Homeostasis, Diabetes and Obesity.* Advances in Experimental Medicine and Biology. Berlin, Germany: Springer; 2017. p. 1043.
 23. Jackson AS, Stanforth PR, Gagnon J, Rankinen T, Leon AS, Rao DC, et al. The effect of sex, age and race on estimating percentage body fat from body mass index: The Heritage family study. *Int J Obes.* 2002;26(6):789-96. <https://doi.org/10.1038/sj.ijo.0802006>
PMid:12037649
 24. Schreiner PJ, Terry JG, Evans GW, Hinson WH, Crouse JR, Heiss G. Sex-specific associations of magnetic resonance imaging-derived intra-abdominal and subcutaneous fat areas with conventional anthropometric indices: The atherosclerosis risk in communities study. *Am J Epidemiol.* 1996;144(4):335-45. <https://doi.org/10.1093/oxfordjournals.aje.a008934>
PMid:8712190
 25. Després JP, Couillard C, Gagnon J, Bergeron J, Leon AS, Rao DC, et al. Race, visceral adipose tissue, plasma lipids, and lipoprotein lipase activity in men and women: The health, risk factors, exercise training, and genetics (HERITAGE) family study. *Arterioscler Thromb Vasc Biol.* 2000;20(8):1932-8. <https://doi.org/10.1161/01.atv.20.8.1932>
PMid:10938014
 26. Demerath EW, Sun SS, Rogers N, Lee M, Reed D, Choh AC, et al. Anatomical patterning of visceral adipose tissue: Race, sex, and age variation. *Obesity.* 2007;15(12):2984-93. <https://doi.org/10.1038/oby.2007.356>
PMid:18198307
 27. Goodman-Gruen D, Barrett-Connor E. Sex differences in measures of body fat and body fat distribution in the elderly.

-
- Am J Epidemiol. 1996;143(9):898-906. <https://doi.org/10.1093/oxfordjournals.aje.a008833>
PMid:8610703
28. Smith SR, Lovejoy JC, Greenway F, Ryan D, De Jonge L, De La Bretonne J, *et al.* Contributions of total body fat, abdominal subcutaneous adipose tissue compartments, and visceral adipose tissue to the metabolic complications of obesity. *Metabolism.* 2001;50(4):425-35. <https://doi.org/10.1053/meta.2001.21693>
PMid:11288037
29. Yim JE, Heshka S, Albu JB, Heymsfield S, Gallagher D. Femoral-gluteal subcutaneous and intermuscular adipose tissues have independent and opposing relationships with CVD risk. *J Appl Physiol.* 2008;104(3):700-7. <https://doi.org/10.1152/jappphysiol.01035.2007>
PMid:18079271