

# Losing Weight through Regular Exercise among Overweight/Obesity Women Aged 35-45 years

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Submitted: December 29<sup>th</sup> 2020; Revised: June 01<sup>st</sup> 2022; Accepted: August 02<sup>nd</sup> 2022

## Keywords:

Lifestyle  
Obesity  
Overweight  
Young women

**Abstract** Exercise is a simple and low-cost way to lose weight, but many people have become apprehensive to provide it. This activity aims to shift the community's lifestyle from sedentary to active by encouraging physical activity through frequent gymnastics. Darussalam housewives gathered near the Universitas Syiah Kuala campus. There were two groups of 20 people: regular participants (n=11) and non-regular participants (n=9). Everyone in the study was between the ages of 30-45. Participants' body weight (BW), height, and Body Mass Index (BMI) were measured before and after treatment. Participants did 60 minutes of gymnastics modified from Zumba, Aerobic, and Salsa, 3-4 times per week, at 05.00-06.00 p.m, for 12 weeks (3 months), and without any special diet. The regular group's average age was 35.3 years, whereas the non-regular group's average age was 36.78 years. The results showed that 80 percent and 22.22 percent of participants in the regular and non-regular groups, respectively, lost weight. Before and after exercise, the regular group's mean BW decreased by 3.65 kg (68.25 and 84.6 vs. 59.19 and 59.25 kg), while the non-regular group's BW increased by 0.06 kg. The regular exercise group's BMI dropped by 1.53 kg/m<sup>2</sup> after gymnastics (28.45 and 26.92 vs. 27.01 and 27.01 kg/m<sup>2</sup>), while the non-regular exercise group's BMI remained unchanged. Gymnastic movements have been modified to include Zumba, Aerobics, and Salsa, which could reduce BW and BMI. As a result, sustained exercise is required to help people reduce their risk of obesity. This practice has helped the government of the Republic of Indonesia's efforts to increase physical activity and decrease the sedentary lifestyle in the population, thereby improving societal health. Obesity in women can be treated and prevented with regular exercise.

## 1. INTRODUCTION

Being overweight is notably dangerous for women, as obesity becomes a nightmarish specter for every woman (Arora, 2019). As a matter of fact, hormonal changes in young adult women (over 30 years old) coupled with the lack of activity (sedentary lifestyle) raise the risk of overweight/obesity and its comorbidities such as hypertension, diabetes, heart disease, and stroke. As a

necessary consequence, the mortality rate goes up (Gallagher et al., 2000; Salomé et al., 2017; Tremblay et al., 2010). Obesity is defined as excess body weight that exceeds 25% of ideal body weight (Lee et al., 2018). Obesity is defined as an abnormal accumulation of body fat or BMI that exceeds the threshold (> 2 standard deviations), or when the percentage of body fat exceeds 20% for men

ISSN 2460-9447 (print), ISSN 2541-5883 (online)

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and 25% for women and can be harmful to one's health (Low et al., 2002). Obesity is described as a condition where it's an absolute or relative excess of body fat (Aktar., et al, 2017; Low et al., 2002).

Obesity is a complicated disease due to the interaction of several risk factors, such as excessive food intake, lack of movement or exercise (sedentary behavior), psychological factors, endocrine disorders, fat metabolism disorders, and genetics (Girdhar et al., 2016). Obesity affects women's physical appearance and attractiveness and becomes a public health issue in all age groups (Vasudevan et al., 2015). Obesity is caused by a multifactorial interaction of genetic and environmental factors, including high-calorie, high-fat, low-fiber eating habits, physical inactivity or laziness, and socioeconomic factors (Tremblay et al., 2010; Tremblay et al., 2005).

Changes in eating habits, as well as a sedentary lifestyle, are two of the most important factors contributing to the rising prevalence of obesity in almost every country around the world, including Indonesia (Harbuwono et al., 2018). Obesity and overweight occur when energy intake exceeds energy expenditure (Lambert & Goedecke, 2003; Aktar., et al, 2017). An imbalance in energy intake and output will result in fat accumulation in adipose tissue (Helble & Francisco, 2017). Low energy expenditure is typically caused by a lack of physical activity and a sedentary lifestyle, whereas high energy intake is typically caused by eating high-fat, high-energy foods (Lambert & Goedecke, 2003). Furthermore, the presence of modern conveniences such as motorized vehicles, elevators, lifts, and air conditioning means that less energy is used to move. A lack of physical activity or a sedentary lifestyle is responsible for more than two million deaths each year. In adults, a lack of physical activity and increasingly sedentary lifestyles such as watching television, using computers, and playing computer games for extended periods (more than 2 hours at a time) tend to increase the incidence of obesity (Adiwinanto, 2008). Sedentary lifestyles are practiced by 60 to 85 percent of the population worldwide.

Obesity is a global health issue as well as a serious public health issue in developing countries, including Indonesia (Harbuwono et al., 2018). Overweight and obesity affect over one billion and 700 million adults worldwide, respectively. Obesity is projected to become a major problem in developing countries, including Indonesia, in the future. According to World Health Organization (WHO) data from 2015, there are 2.3 billion overweight adults and over 700 million obese adults (Girdhar et al., 2016). In 2014, up to 13% of the adult population was obese, with women (15%) having a higher prevalence than men (11%) (Girdhar et al., 2016). In Asia Pacific, the prevalence of overweight adults has risen dramatically. If the prevalence of overweight in 1990 was 34.6 percent, now it has increased steadily to 40.9 percent (Helble & Francisco, 2017).

Overweight and obesity affect people of all ages and socioeconomic backgrounds in Indonesia. Obesity affects

approximately 23.1 percent of the population in Indonesia (Harbuwono et al., 2018). In 2000, Indonesia had 210 million people, with 76.7 million (23.3 percent) overweight and more than 9.8 million (4.7 percent) obese. According to Basic Health Research (Riskesdas) data from 2007, the national prevalence of obesity among people aged 15 was 10.3 percent (male 13.9 percent, female 23.8 percent) (Badan Penelitian dan Pengembangan Kesehatan, 2010). According to WHO, obesity is one of ten health problems that tend to increase the risk of other diseases in almost all countries around the world, and it is also one of five health problems that are at risk of increasing other diseases (comorbid) in several developing countries, including Indonesia (WHO, 2010).

Comorbid diseases associated with obesity include hypertension, glucose intolerance, atherosclerotic coronary heart disease, colorectal cancer, gout and arthritis, respiratory disorders in the elderly, low back pain, infertility, and diminished psychosocial function (Vasudevan et al., 2015). Obesity has become a worldwide epidemic in both developed and developing nations. Obesity is typically prevented and treated using a combination of diet and exercise interventions. Exercise is a powerful tool for weight loss and obesity prevention (Zaharia et al., 2013). Other research indicates that high-intensity interval training is an effective method for weight loss, body fat composition, and waist circumference (Domaradzki et al., 2020). Anam's research found that obese children have low levels of physical activity and fitness. Inadequate physical activity causes more body fat to be deposited on tissue, whereas low physical fitness can harm the physical health of obese children (Anam et al., 2010). Flodmark et al (2004) conducted research in Austria on 14 obese children who were boarded and given a strict exercise and diet program for three weeks, resulting in a weight loss of 4.7 kg.

Women have tried a variety of techniques to lose weight to achieve ideal or normal body weight, including surgery or liposuction. This method is time-consuming and comes with the risk of side effects if performed by non-specialists. There are low-cost and simple ways to lose weight or undergo obesity treatment, such as lifestyle modification through regular and measurable exercise (Swift et al., 2014). The increasingly sedentary lifestyle of Acehnese society has the potential to increase the incidence of obesity and its comorbidities. As a result, an effort is needed to empower these mothers or women to increase their activity and decrease their sitting time to avoid becoming overweight or obese (Mazzeo, 2018; Wollaston et al., 2015). Regular exercise through gymnastics modified from Zumba, aerobics, and salsa has become a way to control and prevent obesity in women. This community service activity aims to help overweight or obese women lose weight. As a result, it lowers the prevalence of obesity in the community and prevents its comorbid diseases. This strategy is beneficial for lowering the mortality and morbidity rates associated with obesity in young women.

## 2. METHOD

Participants were housewives from Darussalam around the Universitas Syiah Kuala campus. The total number of participants was 19 young women (aged 30-45 years). Participants have divided into two groups: one group was women who did regular exercise (a regular- gymnastics group) with ten women, and one group was women who did not do regular exercise (non-regular gymnastics group), amounting to 9 people. The regular exercise group is doing an exercise regularly, with a frequency of at least 3-5 times per week, with the duration of 60 minutes per training session, and for three months (12 weeks). The non-regular exercise group was non-regular exercise women (exercise less than two times/week) for three months (12 weeks). The initial participants were 20 people (11 women for regular gymnastics groups and 9 non-regular gymnastics groups). All participants were willing to volunteer to do exercise according to a predetermined schedule and sign a written informed consent.

Participant’s criteria were female, aged between 30-45 years, physically and mentally healthy based on the results of physical examination and anamnesis, not disabled, not suffered sports injuries or other physical injuries that can interfere with the activity of gymnastics, and willing to be a participant with a willingness to sign a participant community service activity. The subject will be excluded if she is not willing to follow all the action through to completion, gets injured during the implementation of activities, needs special medical treatment, or is treated for health problems.

Physical examinations were carried out, including

weight (BW), height, and Body Mass Index (BMI). All components were carried out twice, before and after 12 weeks of treatment (91<sup>st</sup> day). Gymnastic service activities were provided to participants, which were modified from Zumba, aerobic, and salsa exercises. The movement modification in question is that for one exercise, three types of exercise are carried out, namely 15 minutes for each type of gymnastic with a total of 45 minutes, while 15 minutes for warm-up and cool-down movements. Gymnastics is carried out with a duration of 60 minutes per training session, frequency 3-5 times per week (Monday-Friday), carried out at 05.00-06.00 pm, and for 12 weeks (3 months or 91 days). There have no dietary restrictions or dietary arrangements for all participants during the treatment (gymnastics). The venue for the activity was the Faculty of Medicine, Universitas Syiah Kuala, Darussalam, Banda Aceh. This activity was approved by the Medical and Health research ethics committee of the Medical Faculty, Universitas Syiah Kuala by the registered number 262/EA/FK-RSUDZA/2019.

## 3. RESULTS AND DISCUSSION

The results of the examination can be seen in Table 1. Table 1 reveals that the participants in both groups were between the ages of 30 and 44. The youngest age group was 30 years old (a total of 4 people, or about 21.05%), while the oldest age group was 44 years old (a total of one person, or about 5.26%) of the total number of participants. The average age of the participants in the two groups was different; the regular gymnast group was around 35.3 years old, while the non-regular gymnast group was around 36.78 years old.

Table 1 . Data on the results of the participant’s examination (before and after regular gymnastics)

Participants	Age	Anthropometry						Group
		Weight		Height		BMI		
		Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	
P1	44	66	65	159	159	26.11	25.71	Regular
P2	33	79.5	74	150.5	150.5	35.10	32.67	Regular
P3	42	73	70	155	155	30.39	29.14	Regular
P4	40	62	62	149	149	27.93	27.93	Regular
P5	30	115	108	153	153	49.13	46.14	Regular
P6	32	60	50	155.5	155.5	24.81	20.68	Regular
P7	30	68	65	157.5	157.5	27.41	26.20	Regular
P8	30	74	66	153	153	31.61	28.19	Regular
P9	34	67	64	157	157	27.18	25.96	Regular
P10	30	73	70	157	157	29.62	28.40	Regular
P11	38	60	60	157	157	24.34	24.34	Regular
P1	38	74	74	154	154	31.20	31.20	Non-Regular
P2	34	66	65,5	147	147	30.54	30.31	Non-Regular
P3	37	50.5	50,5	146.5	146.5	23.53	23.53	Non-Regular
P4	35	48	48	136.9	136.9	25.61	25.61	Non-Regular
P5	34	61	60	141	141	30.68	30.18	Non-Regular
P6	35	54	54	146	146	25.33	25.33	Non-Regular
P7	35	74	74	150	150	32.89	32.89	Non-Regular
P8	43	60	62	159	159	23.73	24.52	Non-Regular
P9	40	60	60	159	159	23.73	23.73	Non-Regular

The BW measurement results for the regular gymnast group can be seen in [Table 2](#). This table shows that there was a difference between BW before and after gymnastics regularly. The average weight loss of the community service participants was 3.95 kg after 12 weeks of regular gymnastics. The results also showed that as many as 9 or 81.82% of the participants lost weight, and only about 2 (18.18%) of the participants did not lose weight in the regular gymnastics group. Weight loss for each participant varied from 1 to 10 kg.

[Table 2](#) shows the results of the BMI examination before and after 12 weeks of gymnastics in the regular gymnastics group. The reduction in BMI varied between participants, with the lowest reduction being 0.40 kg/m<sup>2</sup> and the highest being 4.14 kg/m<sup>2</sup>. These findings show that regular gymnastics not only reduced body weight but also BMI values in women aged 35 to 45 years. As a result,

gymnastics can be used as a non-pharmacological weight loss therapy in women aged 35–45 who are overweight or obese. Aerobic, Zumba, and Salsa exercise movements can be modified as a therapeutic modality for overweight or obese patients. Changes in lifestyle from sedentary to actively helped women lose weight, lowering the prevalence of overweight and obesity. Regular physical activity is beneficial for both preventive and curative treatment of obesity in women.

[Table 2](#) also shows the results of the BW examination in the non-regular gymnastics group. According to the findings, only two people (22.22 percent) experienced a decrease in body weight, while the remaining six people (66.67 percent) did not. There was even one participant (11.11 percent) whose BW increased by 2 kg after irregular gymnastics. These findings suggest that irregular gymnastics (less than three times per week) cannot

**Table 2 .** Weight, height, and BMI differences before and after gymnastics treatment in the regular and non-regular gymnastics groups

Variable	Groups	Data	Means±SD	Min	Max	P value
Weight (kg)	Regular (n=11)	Pretest	72.50±15.41	60	115	0.54
		Posttest	68.55±14.51	50	108	
	Non-Regular (n=9)	Pretest	60.83±9.31	48	74	0.99
		Posttest	60.88±9.28	48	74	
Height (cm)	Regular (n=11)	Pretest	154.86±3.13	149	159	1.00
		Posttest	154.86±3.13	149	159	
	Non-Regular (n=9)	Pretest	148.82±7.54	136	159	1.00
		Posttest	148.82±7.54	136	159	
BMI (kg/m <sup>2</sup> )	Regular (n=11)	Pretest	30.33±6.97	24.34	49.13	0.57
		Posttest	28.67±6.54	20.68	46.14	
	Non-Regular (n=9)	Pretest	27.47±3.78	23.54	32.89	0.74
		Posttest	27.48±3.62	23.53	32.89	

help overweight or obese women lose weight. As a non-pharmacological therapy, regular exercise is recommended in overweight or obese women to reduce weight and BMI. [Table 2](#) describes that the BMI before and after gymnastics did not change in the non-regular gymnastics group. This shows that irregular exercise did not affect weight loss or BMI in overweight or obese women. Energy expenditure due to exercise is highly dependent on the type of exercise (aerobic, resistant training, or a combination of both), intensity (mild-moderate), duration (45-60 minutes), frequency (5-7 times per week), and performed regularly ([Pyšná et al., 2020](#)).

Although there was a decrease in weight and BMI after 12 weeks of regular exercise based on descriptive data analysis, data analysis using an independent sample t-test revealed that there was no effect of regular exercise on weight loss and BMI in the regular gymnast group. as well as non-regular gymnasts (p>0.05). [Table 2](#) also shows that there is a height difference between the regular and non-regular gymnast groups. This is because some non-regular gymnasts have lower-than-average body weight. This value has no bearing on the outcome of this service activity because height is not an observed variable, but rather serves as supporting data to assess.

Excess calorie intake is stored as body fat, and chronic

excessive food consumption leads to obesity ([Naureen et al., 2022](#)). Obesity is directly related to a decrease in daily energy expenditure as a result of decreased physical activity, which leads to an increase in body fat stores and an increase in body weight or obesity ([Japutra et al., 2015](#); [Wiklund, 2016](#)). Obesity can be managed by altering one’s lifestyle by controlling food intake and energy expenditure ([Petridou et al., 2019](#)). Physical activity or exercise has long been recognized as an effective way to increase energy expenditure and reduce body fat deposits in obese or overweight people, with or without dietary restrictions ([Fernandez et al., 2004](#)). Physical activity boosts energy metabolism and adipose tissue metabolism, both of which are linked to obesity ([Pyšná et al., 2020](#)). Obesity risk is reduced by aerobic exercise, resistance training, or a combination ([Brellenthin et al., 2021](#)).

Exercise can increase lipolysis and decrease visceral fat, making it an excellent strategy for reducing abdominal obesity ([Petridou et al., 2019](#)). Aerobic exercise for eight weeks to 18 months, according to empirical evidence, can reduce the fat percentage by 5 to 10% ([Fernandez et al., 2004](#)). We discovered that a 12-week regimen of aerobic exercise, salsa, and Zumba had a non-significant reduction in body weight in overweight and obese women. Suman also attempted to claim that aerobics for eight weeks

reduced BW and BMI in men and women aged 24–40 in Baroda, Gujarat (Suman, 2016). Other findings suggest that a 12-week combination of aerobic exercise and resistance training was more efficient than either aerobic exercise or resistance training in losing weight in overweight and obese people (Ho et al., 2012). When compared to positive energy balance, exercise increases it by 3 to 10 times. As a result, 45–60 minutes of moderate-intensity exercise per day can reduce fat deposits and prevent obesity (Lambert & Goedecke, 2003; Zaharia et al., 2013).

Previous research also indicated that aerobic gymnastics can help 1 in 5 women aged 20–25 years lose 0.73 percent of their body weight (Yusni, 2014). Women's BMI can be diminished by 6 weeks of low-impact aerobic gymnastics (Fepriyanto et al., 2019). Aerobic exercise for 6 weeks can significantly reduce BMI in overweight and obese women aged 17–22 years (Muriyati et al., 2018). Obesity is caused by an imbalance between energy intake and energy expenditure, and exercise is one way to increase energy expenditure, lipolysis, and reduce body fat as well as a fat percentage (Fernandez et al., 2004; Muriyati et al., 2018; Philippou et al., 2019). Even without a strict diet, exercise is more effective at losing weight and preventing obesity ((Philippou et al., 2019).

## 4. CONCLUSION

This community service activity has helped the participants to increase their physical activity and prevent a sedentary lifestyle; therefore, it can control and prevent overweight/obesity in young women.

## ACKNOWLEDGMENT

Thanks to the Institute of Research and Community Service of Universitas Syiah Kuala, which has funded the implementation of community service activities through grant funding sources dedication of Universitas Syiah Kuala with a grant number: 525/UN11/SPK/PNBP/2019 dated February 8, 2019. Thank you very much for the willingness of participants to volunteer to participate in this service activity. Without their help, this activity would not be carried out as expected.

## CONFLICT OF INTERESTS

The implementation and publication of this community service activity are known and approved by all teams; therefore, there is no conflict of interest in this activity.

## REFERENCES

Adiwinanto W. (2008). *Effect of school exercise intervention on body mass index and physical fitness of obese adolescents*. [Master's thesis, Universitas Diponegoro]. [http://eprints.undip.ac.id/28849/1/Wahyu\\_Adiwinanto\\_Tesis.pdf](http://eprints.undip.ac.id/28849/1/Wahyu_Adiwinanto_Tesis.pdf)

Aktar, N., Qureshi, N. K., & Ferdous, H. S. (2017). Obesity: A review of pathogenesis and management strategies in adult. *Delta Medical College Journal*, 5(1), 35–48.

<https://doi.org/10.3329/dmcj.v5i1.31436>

Anam, M., Mexitalia, M., Widjanarko, B., Pramono, A., Susanto, H., & Subagio, H. W. (2010). Pengaruh intervensi diet dan olahraga terhadap indeks massa tubuh, lemak tubuh, dan kesegaran jasmani pada anak obes. *Sari Pediatri*, 12(1), 36–41. <https://doi.org/10.14238/sp12.1.2010.36-41>

Arora, A. (2019). Fighting obesity with a smile. *Acta Scientific Nutritional Health*, 3(5), 64–70.

Badan Penelitian dan Pengembangan Kesehatan. Kementerian Kesehatan Republik Indonesia. (2010). *Riset kesehatan dasar 2010*. Kementerian Kesehatan Republik Indonesia. [http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2010/lp\\_rkd2010.pdf](http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2010/lp_rkd2010.pdf)

Brellenthin, A. G., Lee, D. C., Bennie, J. A., Sui, X., & Blair, S. N. (2021). Resistance exercise, alone and in combination with aerobic exercise, and obesity in Dallas, Texas, US: A Prospective Cohort Study. *PLoS Medicine*, 18(6). <https://doi.org/10.1371/journal.pmed.1003687>

Domaradzki, J., Cichy, I., Rokita, A., & Popowczak, M. (2020). Effects of tabata training during physical education classes on body composition, aerobic capacity, and anaerobic performance of under-, normal- and overweight adolescents. *International Journal of Environmental Research and Public Health*, 17(3), 876. <https://doi.org/10.3390/ijerph17030876>

Fepriyanto, A., Helaprahara, D., & Rasyid, A. (2019). The impact of low impact aerobic gymnastics on body mass index and thigh circumference. *Jurnal Pendidikan Jasmani Dan Olahraga*, 4(1), 103–110.

Fernandez, A. C., Túlio de Mello, M., Tufik, S., Morcelli de Castro, P., & Fisberg, M. (2004). Influence of the aerobic and anaerobic training on the body fat mass in obese adolescents. *Revista Brasileira de Medicina Do Esporte*, 10(3), 152–164. <https://doi.org/10.1590/s1517-86922004000300004>

Flodmark, C. E., Lissau, I., Moreno, L. A., Pietrobelli, A., & Widhalm, K. (2004). New insights into the field of children and adolescents obesity: The European perspective. *International Journal of Obesity*, 28(10), 1189–1196. <https://doi.org/10.1038/sj.ijo.0802787>

Gallagher, D., Heymsfield, S. B., Heo, M., Jebb, S. A., Murgatroyd, P. R., & Sakamoto, Y. (2000). Healthy percentage body fat ranges: An approach for developing guidelines based on body mass index. *The American Journal of Clinical Nutrition*, 72(3), 694–701. <https://doi.org/10.1093/ajcn/72.3.694>

Girdhar, S., Sharma, S., Chaudhary, A., & Bansal, P. (2016). An epidemiological study of overweight and obesity

- among women in an urban area of North India. *Indian Journal of Community Medicine*, 41(2), 154–157. <https://doi.org/10.4103/0970-0218.173492>
- Harbuwono, D. S., Pramono, L. A., Yunir, E., & Subekti, I. (2018). Obesity and central obesity in Indonesia: Evidence from a national health survey. *Medical Journal of Indonesia*, 27(2), 114–120.
- Helble, M., & Francisco, K. (2017). *The imminent obesity crisis in Asia and the Pacific: First cost estimates*. Asian Development Bank Institute.
- Ho, S. S., Dhaliwal, S. S., Hills, A. P., & Pal, S. (2012). The effect of 12 weeks of aerobic, resistance, or combination exercise training on cardiovascular risk factors in the overweight and obese in a randomized trial. *BMC Public Health*, 12(1), 1. <https://doi.org/10.1186/1471-2458-12-704>
- Japutra, A., Fadlyana, E., & Alam, A. (2015). Risk factors for obesity in 6 to 12-year-old children. *Paediatrica Indonesiana*, 55(1), 35. <https://doi.org/10.14238/pi55.1.2015.35-9>
- Lambert, E. V., & Goedecke, J. H. (2003). Energy balance and energy expenditure in obesity-is obesity a disease of inactivity?. *Sports Medicine*, February, 21–25.
- Lee, S. J., & Ryu, H. K. (2018). Relationship between dietary intakes and the double burden of malnutrition in adults of Malang, Indonesia: An exploratory study. *Nutrition Research and Practice*, 12(5), 426–435.
- Low, S., Chin, M. C., Ma, S., Heng, D., & Deurenberg-yap, M. (2002). Rationale for redefining obesity in Asians. *Annals Academy of Medicine*, 38, 66–74.
- Mazzeo, F. (2018). Current concept of obesity. *Sport Science* 9, 2.
- Muriyati, M., Patima, P., & Suswani, A. (2018). Aerobic exercise on body mass index (BMI) change in person with overweight and obesity. *Indonesian Nursing Journal of Education and Clinic (Injec)*, 2(1), 32. <https://doi.org/10.24990/injec.v2i1.5>
- Naureen, I., Saleem, A., Naeem, M., Bilal, N.-M., Hassan, G. M., Shafiq, M., Hussain, M., & Roohullah, S. (2022). Effect of exercise and obesity on human physiology. *Scholars Bulletin*, 8(1), 17–24. <https://doi.org/10.36348/sb.2022.v08i01.003>
- Petridou, A., Siopi, A., & Mougios, V. (2019). Exercise in the management of obesity. *Metabolism: Clinical and Experimental*, 92, 163–169. <https://doi.org/10.1016/j.metabol.2018.10.009>
- Philippou, A., Chryssanthopoulos, C., Maridaki, M., & Koutsilieris, M. (2019). The role of exercise in obesity. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 13(5), 2861–2862. <https://doi.org/10.1016/j.dsx.2019.07.061>
- Pyšná, J., Pyšný, L., Cihlář, D., Petrů, D., & Škopek, M. (2020). Effect of physical activity on obesity in second stage pupils of elementary schools in Northwest Bohemia. *Sustainability (Switzerland)*, 12(23), 1–14. <https://doi.org/10.3390/su122310042>
- Salomé, A., Barnes, J., & Tremblay, M. (2017). New sedentary behaviour definitions: A terminology consensus project by the sedentary behaviour research network. *Wellspring*, 28(10), 1–5.
- Suman, C. (2016). Aerobic exercise programme and reduction in body weight and body mass index (BMI). *Galore International Journal of Health Sciences Research*, 1(1), 41–44. [https://www.gijhsr.com/GIJHSR\\_Vol.1\\_Issue.1\\_Dec2016/7.pdf](https://www.gijhsr.com/GIJHSR_Vol.1_Issue.1_Dec2016/7.pdf)
- Swift, D. L., Johannsen, N. M., Lavie, C. J., Earnest, C. P., & Church, T. S. (2014). The role of exercise and physical activity in weight loss and maintenance. *Progress in Cardiovascular Diseases*, 56(4), 441–447. <https://doi.org/10.1016/j.pcad.2013.09.012>
- Tremblay, M. S., Colley, R. C., Saunders, T. J., Healy, G. N., & Owen, N. (2010). Physiological and health implications of a sedentary lifestyle. *Applied Physiology, Nutrition, and Metabolism*, 35(6), 725–740. <https://doi.org/10.1139/h10-079>
- Tremblay, M. S., Pérez, C. E., Ardern, C. I., Bryan, S. N., & Katzmarzyk, P. T. (2005). Obesity, overweight and ethnicity. *Health Reports*, 16(4), 23–34.
- Vasudevan, D. A., Klawans, M. R., Northrup, T. F., & Stotts, A. L. (2015). Diagnosis and management of obesity among South Asians-a paradigm. *Journal of Family Medicine Community Health*, 2(7), 1–5.
- Wiklund, P. (2016). The role of physical activity and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, 5(2), 151–154. <https://doi.org/10.1016/j.jshs.2016.04.001>
- Wollaston, S., Conservative, M. P., Cooper, R., Labour, M. P., Lancashire, W., George, A., & West, B. N. (2015). *Impact of physical activity and diet on health*. House of Commons.
- World Health Organization. (2010). *Global recommendations on physical activity for health*. WHO Press. [https://www.ncbi.nlm.nih.gov/books/NBK305057/pdf/Bookshelf\\_NBK305057.pdf](https://www.ncbi.nlm.nih.gov/books/NBK305057/pdf/Bookshelf_NBK305057.pdf)
- Yusni. (2014). Lose weight and prevent obesity by aerobic gymnastics. *Proceedings of The 4th Annual International Conference Syiah Kuala University (AIC Unsyiah) 2014 In Conjunction with The 9th Annual International Workshop and Expo on Sumatra Tsunami Disaster and Recovery – AIWEST-DR 2014*, 144–148. <https://media.neliti.com/media/publications/174600-EN-lose-weight-and-prevent-obesity-by-aerob.pdf>

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Zaharia, A., Dobrescu, T., & Rata, G. (2013). The effectiveness of aerobic gymnastics means in preventing and fighting obesity. *Bulletin of the Transilvania University of Braşov*, 6(1), 1–4.