Implications of Tabata Training towards Obesity Levels and Its Factors among Primary School Students

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ABSTRACT

This study aims to identify the impact of Tabata training intervention on the level of obesity and its contributing factors among primary school students. The study addressed four research questions: What is the level of obesity among the primary school students ? What are the factors contributing to obesity among these students? Is there a significant relationship between the main factors of obesity and the students' level of obesity? And does the Tabata training intervention have an impact on the obesity level of these students? The study focused on the area of primary school and employed a quasi-experimental design involving 50 obese students aged 7 to 12. The respondents were divided into two groups: a treatment group (who underwent Tabata training for four weeks) and a control group (who did not receive the intervention). Data collection was conducted using questionnaires, physical fitness tests, and BMI measurements before and after the intervention. The data were analysed using descriptive and inferential statistics, including mean, percentage, correlation tests, and paired t-tests. The analyses were conducted using SPSS version 27. The findings revealed a relationship between genetic factors and the level of obesity among the students, with r=0.146 and a significance value of p=0.311. Additionally, the difference between the treatment and control groups showed t=9.483 for the treatment group and t=0.053 for the control group. The study suggests that the "One Student, One Sport" policy is a viable program to encourage greater physical activity among primary school students, contributing to the mitigation of obesity.

Keywords: Level, Factor, Obesity, Intervention, Primary School

INTRODUCTION

The majority of Malaysians are actually not very aware of proper and healthy eating methods, which has resulted in them becoming obese due to neglecting their diet. In a study conducted by the World Health Organization in 2019, it was found that 23% of adults and 81% of teenagers could not meet the global recommendations for maintaining Body Mass Index.

This situation is not a small number because the number of teenagers who do not follow global recommendations is very high and concerning. For example, a study conducted by Aekplakorn et al. (2020) stated that Thailand also experienced an increase in the rate of obesity problems among children aged around five to twelve years, which was only 12% in the past and changed to 15% in the following year. This number will continue to rise if there are no effective solutions in a country.

50.1% of Malaysians are classified as fat or overweight, according to the NHMS (2019). This translates to 19.7% of people being obese and 30.4% being overweight. When compared to earlier statistics, this growth is really alarming. This is evident from the fact that in 2011, 29.4% of people were classified as overweight and 15.1% as obese. According to the research findings, the three categories most affected by obesity are women (54.7%), those of Indian ethnicity (63.9%), and people aged 55 to 69 (60.9%).

Overall, a variety of variables might contribute to obesity, such as genetics or heredity, which implies that pupils inherit from their parents and other family members. Whether a kid has embraced balanced or not, their food habits are also directly linked to this issue. If not, this issue will probably result in a kid gaining weight because obesity is partly influenced by diet. Additionally, someone has become obesity as a result of their habit of not exercising. This is due to the fact that physical activity aids in fat burning, which in turn helps to avoid

obesity. Thus, engaging in physical activity allows for the burning of body fat, thereby preventing obesity. During childhood, it is essential for children to participate in physical activities to support motor development, strength, and endurance. Involvement in physical activities can promote physical growth and mental health Ismail et al. (2018). Indirectly, this can prevent the occurrence of diseases such as obesity among children as they maintain a good level of fitness. Furthermore, excessive use of technological devices will result in individuals not engaging in outdoor activities and sports such as playing football, jogging, and badminton due to gadget and technology addiction, which leads them to avoid outdoor activities. Such physical activities are very important for an individual because these activities can help eliminate the fats in the body that are not used in daily activities, making a person healthy and addressing the problem of obesity. A study by Brown T. et al. (2019), published by Cochrane, found that strategies to change nutrition and increase physical activity levels among children can help prevent obesity. In addition, the habit of lacking involvement in stimulating physical activities such as sports during leisure time has caused individuals, including children, to become obese due to the accumulation of unused fats in their bodies. This is because some people believe that obese children are still young and healthy and will return to a normal Body Mass Index as they grow up.

Thus, the purpose of this study was to determine how Tabata training affected the prevalence of obesity and its contributing variables among primary school students.

REVIEW OF PREVIOUS STUDIES

The problem of obesity and overweight is an issue faced by the entire world. According to the United Nations, it is estimated that the number of children under five years old facing this problem will increase from 42 million to 70 million in the next 10 years. Not only that, this problem is also faced by children in Malaysia, as their numbers are very concerning to all parties. In an article titled "Ultraprocessed food consumption and risk of overweight and obesity" written by Raquel de Deus Mendonc et al. (2016), it is stated that a continuous change in a person's food system will promote obesity. Now there are more ready-to-eat or heat-up foods known as ultraprocessed foods, such foods have high amounts of fat, sugar, and salt, high energy density, and low fiber content. A total of 2967 (35.1%) men and 5484 (64.9%) women were included in this analysis. The study results were analyzed, referring to participants in the fourth quartile of the highest ultraprocessed food consumption BMI, who were more likely to be current smokers, watch more television, and have the highest energy and fat intake and the lowest protein and fiber intake compared to the first quartile. Moreover, on average, they consumed more fast food, fried food, processed meat and others, and sugary drinks. Conversely, they have the lowest vegetable intake and are less likely to follow a special diet.

Furthermore, the study conducted by Anderson et al. (2019) titled "Disparities in Obesity Among Rural and Urban School Children in China: A Cross-Sectional Study." This study explains that there is a difference in prevalence between obese children and those with excess weight. Most of the obese children are those who live in urban areas compared to those who live in rural areas. However, each year shows a significant increase among children in rural areas. Additionally, upon examination, there are several factors that contribute to the occurrence of obesity. Among them, children in urban areas are more exposed to fast food and high-calorie foods, while children in rural areas are more inclined towards a healthier traditional diet, which includes more vegetables and avoids fast food. Next, through the involvement in physical activities, it can be observed that children in rural areas are more engaged in daily physical activities compared to children in urban areas who are more exposed to a sedentary lifestyle such as resting, playing gadgets, and so on. Such actions will expose a person to the symptoms of obesity. Lastly, regarding socioeconomics, which refers to the higher socioeconomic status of those living in urban areas, it leads them to make unhealthy food choices and adopt an inactive lifestyle.

In this context, intervention is one of the methods that can be used to address an issue or problem encountered in a particular form of study. The use of intervention must be precise in conducting a study so that the intervention method can resolve the issues or problems that arise. This is supported by Siti Khadijah Kaimin (2020), who states that, in general, intervention is defined as a way to change a person's thoughts, emotions, or behaviors. In the context of this study, the intervention to be implemented will be able to bring about a change in behavior and mindset of an individual from someone with a Body Mass Index (BMI) at the obese level to a better stage. The change will enhance an individual's self-confidence and overall mental well-being (Tarmizi,

Pa & Kamaruzaman, 2023).

In this study, the intervention implemented was Tabata Training. This exercise is a form of training that is very organized and well-structured. The meaning of "tabata" originates from the name of a sports scientist from Japan, Dr. Izumi Tabata. This training was created when he was conducting a form of research related to high-intensity training around the year 1996. This training usually involves 8 sets of exercises carried out in performing activities with varying levels of intensity. This exercise is a form of training that allocates high-intensity activities for 20 seconds in each activity. After completing the activity, the person will rest for 10 seconds. This program will repeat for several cycles. Generally, the total time taken is 4 minutes. Such training can help improve a person's cardiovascular endurance and muscle strength.

However, there are also several differing views regarding the duration and time allocated for Tabata training, which is a total of three minutes with intervals of around 30 seconds during the training session. In this regard, this view differs from Ryzkova, Labudova, Grznar, and Smida (2018) who state that Tabata training is a form of exercise that should be conducted for about 20-60 minutes in each training session. A single Tabata training session for a week should not be done too frequently. It is recommended to do it once a week or only two times a week, or if done frequently, only three days a week (Demirci et al., 2017). Here is an example of the implementation of Tabata training introduced by Izumi Tabata (2018). When starting a Tabata training method, all parties are asked to perform a form of body warm-up that is appropriate for the body, which is around 10 minutes per person, and estimate that the VO2max rate is only at 50% of its level. The level must be in a controlled state and not too high. When wanting to carry out the training. A person needs to be in a state of performing 7-8 activities at a rate of up to 20 seconds for each activity performed. The intensity rate is around 170% VO2max when performing the activity, with an appropriate rest period of 10 seconds before starting the next activity. The optimal training intensity will help an individual determine the appropriate VO2max level corresponding to the prescribed training.

Therefore, there are many benefits to be gained if a form of Tabata training is implemented. Among other things, a person will be able to adapt to training in a limited time. Furthermore, through this Tabata training, an individual will enhance their aerobic and anaerobic systems because Tabata is conducted in a short period but with high intensity. This will indirectly improve a person's fitness to address the issue of obesity among the students of primary school.

RESEARCH METHODOLOGY

The study conducted used a quasi-experimental design by assigning a number of respondents with certain characteristics to a group of respondents. The study conducted involved a total of 50 respondents consisting of students from Sekolah Kebangsaan Seafield 3 aged between 7 to 12 years. The sampling that has been conducted is under purposive sampling conditions. Purposive sampling means that the study participants who are selected intentionally have been assigned certain characteristics that are appropriate for the purpose of the study being conducted. Therefore, in this study, the researcher selected the criteria that the study participants must be in an obese condition.

In this study, Google Form was used in an effort to obtain information related to the study respondents. After that, all respondents will be involved in the study with the division into control and treatment groups in the implementation of the training intervention. The information data collected through Google Form using the five-point Likert scale data collection method. The research instrument that has been distributed will be analyzed using SPSS version 27.

RESEARCH FINDINGS

Table I Normality Test for Variabes Related To Obesity Factors

Variables	Kolmogorov-Smirnov		
	Statistic	Df	Sig.
Genetics	.226	50	.070

Eating Habits	.147	50	.065
Physical Activity	.122	50	.061
Environmental Influence	.101	50	.200
Television Influence	.104	50	.200

Based on Table 1 above, which has used the Kolmogorov-Smirnov normality test to obtain data related to whether the data obtained is normally distributed or otherwise. The results of the analysis to obtain significant values (p> 0.05) have shown that for the hereditary aspect, the value is (p=0.70), for the dietary practice aspect, the significant value is (p=0.065), for the physical activity aspect, the significant value is (p=0.061), and for the environmental influence and television influence aspects, the significant value is (p=0.200). Therefore, all the data from the obtained information indicate that this data is normally distributed for all these variables.

The data obtained is consistent with Chua (2008), who states that if the significant value (sig > 0.05) has been met, it can be assumed that the data is normally distributed. So, in the data obtained, it has shown that all the variables have demonstrated a normal distribution.

Table II Respondent Demographics by Gender

Gender	Number	Percentage (%)
Male	38	76
Female	12	24

Based on Table 2, it is clear that the table above explains the sample distribution according to gender percentage for the students of primary school who were given the questionnaire to answer. Most of the respondents are male students, totaling 38 (76%), while female students number 12 (24%). Therefore, from the data obtained according to gender answered by the students of primary school, it is clear that the study sample mostly consists of male students, which is higher than female students for this group.

Table III Respondent Demographics By Age

Body Mass Index (Respondents')	Mod	Median	Min	Standard Deviation
50	24.45	24.97	25.89	5.02

Based on the results of the study conducted, Table 3 above clearly presents the percentage breakdown by age group for the students of primary school involved in the study. Based on the data obtained, it shows that the age group with the highest number of respondents in this study involves students aged seven and 11, totaling 9 people (18%). Next, for the age groups of eight, nine, 10, and 12 years, all have the same number of respondents, which is eight people (16%). Therefore, it can be seen that the groups of students who dominate the study conducted are those aged seven and 11 compared to the other age groups.

Table IV Distribution of Respondents Body Mass Index

Category	Total of the respondents	Percentage (%)
Underweight	0	0
Normal Body Weight	0	0
Excessive Body Weight	0	0
Obesity	50	100

The results of the conducted study show Table 4, which refers to the distribution of respondents according to the obtained BMI categories. All categories have their own meanings that refer to the BMI status of a respondent in the study that has been conducted. The results of the study conducted show that in the categories of underweight, normal weight, and overweight, there were no respondents (0%) in this study who fell into these categories. However, the situation is different when a total of 50 respondents (100%) were found to be obese based on the results of the questionnaire answered by the respondents. The findings clearly indicate that the BMI of all respondents is at the obesity level. This matter is very concerning because if it is not addressed, it will lead to them being involved with chronic diseases at a young age. The results of this finding are very different and far surpass the findings of other studies related to obesity. In a study conducted by (NIH, 2019), it was stated that approximately 19.74% of individuals in Malaysia are at the obesity level. This matter needs to be addressed because if appropriate solutions are not taken by certain parties, it will lead to various problems in the future.

Table V Respondents Body Mass Index

Age	Number	Percentage (%)
7 years old	9	18
8 years old	8	16
9 years old	8	16
10 years old	8	16
11 years old	9	18
12 years old	8	16

Based on Table 5 mentioned above, regarding the Body Mass Index (BMI) of the respondents, the mode, median, mean, and standard deviation related to the BMI of the respondents in the conducted study. Overall, from all 50 respondents in the study, data related to the mode, median, mean, and standard deviation have been presented. For this data, (M=25.89) was obtained in this data and the standard deviation is 5.02. Furthermore, the mode and median in this study show that 24.45 and 24.97 were obtained from the overall data related to the respondents' BMI. Therefore, it can be observed that the overall respondents are in the obesity category based on the findings obtained according to their respective age groups.

Table VI Mean and Standard Deviation for Factors Contributing To Obesity

Factor	Min	Standard Deviation
Genetics	3.80	0.92
Eating Habits	3.66	0.76
Physical Activity	3.16	0.60
Environmental Influence	3.28	0.82
Television Influence	3.28	0.82

Based on Table 6, which refers to the mean and standard deviation for each factor in the study that has been conducted, namely heredity, dietary practices, physical activity, environmental influence, and television influence. Each of these factors has its own mean and standard deviation and will not be combined with the others. For the first factor, which is heredity, it has a mean value of 3.80, and its standard deviation is 0.92. Upon examination, the mean value for the hereditary factor is the highest among all factors in this study, supported by the Broad Institute (2023), which has conducted research on more than 100 human genetic

regions related to obesity. The results of this study indicate that genetics have influenced an individual's weak segments as well as their body mass index. This clearly shows that obesity is also influenced by an individual's genetics.

Next, for the dietary practice factor examined in this study, it shows that the mean value for this factor is 3.66 and the standard deviation for this factor is 0.76. The value for this factor is slightly lower compared to the first factor, which is related to genetics. However, this factor is also one of the second highest among the respondents in the study conducted. This is supported by Obesity Data and Statistics (2023), which stated that methods of food intake that are very high in sugar, calories, and fat but low in nutritional value have contributed to the obesity situation in the United States. Furthermore, unhealthy and unbalanced nutrition will contribute to increasingly severe health conditions if not addressed promptly and appropriately.

For the third factor, which is physical activity, the factor with the lowest value among all factors has been observed in this study. The mean value for physical activity in this study is 3.16 and the standard deviation is 0.60, which is the weakest or lowest mean value among the factors in the study that has been conducted. Furthermore, in this study, the fourth and fifth factors, namely television influence and environmental influence, shared the mean and standard deviation values. In this study, the mean value for this factor was 3.28, with a standard deviation of 0.82. The results indicate that each factor has different conditions and does not have the same value for all factors because each factor will be influenced by certain elements. In conclusion, there are various factors that can lead to obesity among respondents, as evidenced by the findings of the conducted study.

Table VII Main Obesity Factors Related To Student Obesity Levels

		Obesity Level	Genetics
	Correlation Coefficient	1	.146
Obesity Level	Sig. (2- tailled)		.311
	N	50	50
	Correlation Coefficient	.146	1
Genetics	Sig. (2- tailled)	.311	
	N	50	50

Furthermore, based on Table 7, it shows the correlation between the level of obesity and heredity for the entire 50 respondents who were previously surveyed. From Table 10, the results of the test analysis can be seen, namely the Pearson correlation clearly shows that there is a relationship between the level of obesity of the students and the main factor in the occurrence of obesity among the respondents, which is the correlation of the study, r = 0.146. However, in the context of the significance value, p = 0.311. This value exceeds the significance level, which is p > 0.05, in the study that has been conducted. Therefore, it is clear that there is a positive relationship between the level of obesity and ethnicity at primary school. The strength of the correlation between the level of obesity and heredity is at a weak level, which is 0.146. Therefore, there is a positive relationship between the level of obesity and the hereditary factor among the students of primary school. This relationship can be observed when r=0.146 occurs. Based on the study conducted by J. Wardle, S. Carnell, et al. (2008) regarding the relationship between children's BMI and their respective parents. The results have shown that there is a positive relationship between the BMI of parents and their children, with the correlation for children with mothers being r = 0.27, while for children with fathers it is r = 0.23 in the study.

Therefore, it is clear that genetics is an important factor in determining whether a person is obese or not. The positive relationship between the two variables has shown that both variables are related to each other. Therefore, the correlation between the level of obesity among the students of primary school and genetic factors is related to each other in determining whether a particular student is obese or not.

Table VIII Tabata Training Intervention on the Implications of Obesity Levels among Students in the Treatment Group

Before Treatment Group & After Treatment Group	
1.568	Min
.8267	Standard Deviation
.1653	Standard Error of the Mean
1.2267	95% Confidence Level for the Difference (Lower) (Upper)
1.9093	
9.483	T
24	df
<.001	Significant

Based on Table 8, it shows the implications of the tabata training intervention on the obesity levels of students at primary school in the treatment group. In this study, the respondents were divided into two groups, namely the treatment group and the control group. Based on Table 8, it explains a type of test that has been conducted in the analysis process, namely the paired sample t-test, which was implemented to measure two sets of data related to the group before and after the intervention was carried out on them.

The results of the data analysis found that the mean value for the difference between the two types of groups is approximately 1.568, indicating that there is a difference, whether it is an increase or a decrease, in the findings of the respondents in the study that has been conducted. Furthermore, based on Table 11, it explains the standard deviation value in these findings, which is (SD=0.8627). Moreover, the table has shown the mean standard error in this study, with a value of 0.16536 in this data, indicating that the smaller the obtained value, the more accurate it is in representing the entire data. Next, the 95% confidence interval in these findings has shown that it is estimated to be around 1.2267 and 1.9093. This value has exceeded 0 and has indicated that this is a significant value in this study.

Additionally, Table 8 presents the t-values related to the study that has been conducted. This value aims to assess the strength of the difference between the two sets of data obtained in the conducted study. The higher the t-value obtained, the more clearly it indicates a significant difference in the study conducted. The results indicate that the t-value in this finding is t=9.483 in the conducted study. Therefore, it is clearly evident that Tabata training has a very positive effect on the results for the respondents. This is also supported by the article titled "Tabata Training Compared to Cardiovascular Training and Control Group" published in 2021 by the European Union Digital Library, which explains that the effects of Tabata training can have a positive impact on aspects such as an individual's weight loss, body fat percentage, and physical fitness level compared to the control group in the study that was conducted.

Finally, the p-value in this study that has been conducted is $p<0.001$. In this finding, it shows that the obtained p-value is far from the minimum significant value of 0.05. Therefore, it indicates that the difference between the pre- and post-values is highly significant in the results of the conducted study.

Table IX Tabata Training Intervention on the Implications of Obesity Levels among Students in the Control Group

Before Control Group & After Control Group	
.004	Min

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.4171	Standard Deviation
.0834	Standard Error of the Mean
-.1678	95% Confidence Level for the Difference (Lower) (Upper)
.1766	
.053	T
24	df
.958	Significant

Table 9 explains the findings on the impact of the Tabata intervention on the obesity levels of students at primary school in the control group. The results of this test were conducted using a paired sample t-test analysis. In this result, it has explained the mean value obtained in this test. The average value result is obtained from the difference in values before and after the form of the test, which makes the average value 0.0044. This clearly indicates that there is a very small change or no significant change in the control group. For the standard deviation value in this study for the control group, it was found that the standard deviation value is (SD=0.4171) obtained in the results of this study for the control group.

Next, from the table presented regarding the mean standard error in this study, its value is 0.0834, indicating that the obtained data is stable. For the 95% confidence value in this table, it has been estimated at -0.1678 for the lower limit of change and 0.1766 for the upper limit of the average change. In this, it is clear that the value 0 has been included, which has proven that there is no significant difference in the data before and after. In addition, Table 9 has explained the value, namely t, related to the study conducted. This value is to illustrate the strength of the difference in the two obtained data sets. If the t value is higher, we will see a significant difference in this study. In this data, it shows t=0.053. This value is extremely low and very small, indicating that this value is very small and shows a lack of significant level in the dataset. Next, for the significant value in these findings, it explains the p-value. In this data, the p-value is 0.958. this value is much larger than a standard significance level. From this data, it can be observed that the difference between before and after is not statistically significant.

Therefore, it can be shown that there is a difference between the treatment and control groups in the study conducted. This is because the treatment group was given an intervention, namely tabata training, compared to the control group.

DISCUSSION

Overall, this study has elaborated on the level of obesity among the students of Sekolah Kebangsaan Seafield 3, the factors contributing to obesity, the main factors of obesity related to the students' obesity levels, and the implications of the Tabata training intervention conducted on the obesity levels of the students of Sekolah Kebangsaan Seafield 3.

For the level of obesity among the students of Sekolah Kebangsaan Seafield 3, it shows that all categories have their own meanings referring to the BMI status of each respondent in the study that has been conducted. The results of the conducted study indicate that in the categories of underweight, normal weight, and overweight, there were no respondents (0%) in this study who fell into those categories. However, the situation is different when a total of 50 respondents (100%) were found to be obese based on the results of the questionnaire answered by the respondents. The findings clearly indicate that the BMI of all respondents is at the obesity level. This matter is very concerning because if it is not addressed, it will lead to them being involved with chronic diseases at a young age. The results of this finding are very different and far surpass the findings of

other studies related to obesity. In a study conducted by (NIH, 2019), it was stated that approximately 19.74% of individuals in Malaysia are at the obesity level. Additionally, findings from a study conducted in Indonesia by Sofi Oktaviani, Mayumi Mizutani, Ritsuko Nishide et al. (2023) also indicate that 17.5% of the children fall into the category of obesity and overweight. Therefore, it can be seen that the increase in age during childhood is actually a serious condition that needs to be addressed to prevent the worsening of obesity among children.

Next, for the factors contributing to obesity, it is shown based on Table 6 which refers to the mean and standard deviation for each factor in the study that has been conducted, namely genetics, dietary practices, physical activity, environmental influence, and television influence. Each of these factors has its own mean and standard deviation and will not be combined with the others. For the first factor, which is heredity, it has a mean value of 3.80, and its standard deviation is 0.92. Upon examination, the mean value for the hereditary factor is the highest among all factors in this study, supported by the Broad Institute (2023), which has conducted research on more than 100 human genetic regions related to obesity. The results of this study indicate that genetics have influenced an individual's weak segments as well as their body mass index. This clearly shows that obesity is also influenced by an individual's genetics.

Next, for the dietary practice factor examined in this study, it shows that the mean value for this factor is 3.66 and the standard deviation for this factor is 0.76. The value for this factor is slightly lower compared to the first factor, which is related to genetics. However, this factor is also one of the second highest among the respondents in the study conducted. This is supported by Obesity Data and Statistics (2023), which stated that methods of food intake that are very high in sugar, calories, and fat but low in nutritional value have contributed to the obesity situation in the United States. Furthermore, unhealthy and unbalanced nutrition will contribute to increasingly severe health conditions if not addressed promptly and appropriately.

For the third factor, which is physical activity, the factor with the lowest value among all factors has been observed in this study. The mean value for physical activity in this study is 3.16 and the standard deviation is 0.60, which is the weakest or lowest mean value among the factors in the study that has been conducted. Furthermore, in this study, the fourth and fifth factors, namely television influence and environmental influence, shared the mean and standard deviation values. In this study, the mean value for this factor was 3.28, with a standard deviation of 0.82. The results indicate that each factor has different conditions and does not have the same value for all factors because each factor will be influenced by certain elements. In conclusion, there are various factors that can lead to obesity among respondents, as evidenced by the findings of the conducted study.

Moreover, the main factor of obesity is related to the obesity levels of the students based on the test analysis that has been conducted, where the Pearson correlation clearly shows that there is a relationship between the students' obesity levels and the primary factor in the occurrence of obesity among the respondents, which is the study's correlation of $r = 0.146$. However, in the context of the significance value, $p = 0.311$. This value exceeds the significance level, which is $p > 0.05$, in the study that has been conducted. Therefore, it is clear that there is a positive relationship between the level of obesity and ethnicity at Sekolah Kebangsaan Seafield 3. The strength of the correlation between the level of obesity and heredity is at a weak level, which is 0.146. Therefore, there is a positive relationship between the level of obesity and the hereditary factor among the students of Sekolah Kebangsaan Seafield 3. This relationship can be observed when $r=0.146$ occurs. Based on the study conducted by J. Wardle, S. Carnell, et al. (2008) regarding the relationship between children's BMI and their respective parents. The results have shown that there is a positive relationship between the BMI of parents and their children, with the correlation for children with mothers being $r = 0.27$, while for children with fathers it is $r = 0.23$ in the study.

Therefore, it is clear that genetics is an important factor in determining whether a person is obese or not. The positive relationship between the two variables has shown that both variables are related to each other. Therefore, the correlation between the level of obesity among the students of Sekolah Kebangsaan Seafield 3 and genetic factors is related to each other in determining whether a particular student is obese or not.

Next, the tabata training intervention conducted can have implications for the obesity levels of the students at Sekolah Kebangsaan Seafield 3 in the treatment group. In this study, the respondents were divided into two

groups, namely the treatment group and the control group. Based on Table 8, it explains a type of test that has been conducted in the analysis process, namely the paired sample t-test, which was implemented to measure two sets of data related to the group before and after the intervention was carried out on them.

The results of the data analysis found that the mean value for the difference between the two types of groups is approximately 1.568, indicating that there is a difference, whether it is an increase or a decrease, in the findings of the respondents in the study that has been conducted. Furthermore, based on Table 11, it explains the standard deviation value in these findings, which is (SD=0.8627).

In addition, the table has shown the mean standard error in this study, with a value of 0.16536 in this data, indicating that the smaller the obtained value, the more accurate it will be in representing the entire data. Next, the 95% confidence interval in these findings has shown that it is estimated to be around 1.2267 and 1.9093. This value has exceeded 0 and has indicated that this is a significant value in this study.

Additionally, Table 11 presents the t-values related to the study that has been conducted. This value aims to assess the strength of the difference between the two sets of data obtained in the conducted study. The higher the t-value obtained, the more clearly it indicates a significant difference in the study conducted. The results indicate that the t-value in this finding is t=9.483 in the conducted study.

Therefore, it is clear that Tabata training has a very positive effect on the results obtained by the respondents. This is also supported by the article titled "Tabata Training Compared to Cardiovascular Training and Control Group" published in 2021 by the European Union Digital Library, which explains that the effects of Tabata training can have a positive impact on aspects such as an individual's weight loss, body fat percentage, and physical fitness level compared to the control group in the study that was conducted.

Finally, the p-value in this study that has been conducted is $p<0.001$. In this finding, it shows that the obtained p-value is far from the minimum significant value of 0.05. Therefore, it indicates that the difference between the pre- and post-values is highly significant in the results of the conducted study.

Table 9 explains the findings on the impact of the Tabata intervention on the obesity levels of students at Sekolah Kebangsaan Seafield 3 in the control group. The results of this test were conducted using a paired sample t-test analysis. In this result, it has explained the mean value obtained in this test. The average value result is obtained from the difference in values before and after the form of the test, which makes the average value 0.0044. This clearly indicates that there is a very small change or no significant change in the control group. For the standard deviation value in this study for the control group, it was found that the standard deviation value is (SD=0.4171) obtained in the results of this study for the control group.

Next, from the table presented regarding the mean standard error in this study, its value is 0.0834, indicating that the obtained data is stable. For the 95% confidence value in this table, it has been estimated at -0.1678 for the lower limit of change and 0.1766 for the upper limit of the average change. In this, it is clear that the value 0 is included, which has proven that there is no significant difference in the data before and after.

In addition, Table 9 explains the value, namely t, related to the study conducted. This value is to illustrate the strength of the difference in the two obtained data sets. If the t value is higher, we will see a significant difference in this study. In this data, it shows t=0.053. This value is extremely low and very small, through this value it shows that this value is very small and indicates a lack of significant level in the data set.

Next, regarding the significant value in the results of this study, it explains the p-value. In this data, the p-value is 0.958. this value is much larger than a standard significance level. From this data, it can be observed that the difference between before and after is not statistically significant.

Therefore, it can be shown that there is a difference between the treatment and control groups in the study conducted. This is because the treatment group was given an intervention, namely tabata training, compared to the control group.

Overall, there are many obesity factors among the students of Sekolah Kebangsaan Seafield 3 that can be

considered to assess the level of obesity, the factors of obesity, and the effectiveness of the training provided. As shown in the findings, it indicates that children will experience an increase in Body Mass Index in line with their age. One of the ways to address the excessive increase in BMI that leads to obesity is through careful planning in tackling obesity. The implementation of these activities must be in line with their ages. Based on the study conducted by Piotr Matłosz, Justera Wyszyńska, Muhammad Asif (2021), it is stated that obese children usually do not engage in physical activities regularly. This will easily lead to obesity and an increase in Body Mass Index. Therefore, it is very important for a person to engage in physical activity. According to Evangelia A. Polyzou and Stergios A. Polyzos (2024), a person who frequently walks or uses a bicycle will be able to reduce their obesity levels. This happens because an active lifestyle can reduce a person's body mass index from one level to a better one.

In the conducted study, there are several limitations that can be identified when carrying out the research. In this study, the number of respondents was limited in the conducted research. This will result in the obtained data not being generalizable as a comprehensive finding applicable to all situations. Therefore, in the future, it is recommended to expand the study sample to cover a wider area and include various backgrounds such as urban or rural settings. Furthermore, this study did not examine the comparison of the training conducted with other types of training. Therefore, in the future, such studies are necessary to monitor and understand the causes and effects of the increase in obesity among students.

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