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Association of Weight-for-Height Index with Health-Oriented Physical Fitness, Gait Speed and Health-Related Quality of Life in Middle-Aged Subjects: A Cross-Sectional Study

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Abstract:

- ***Background***

Obesity rates continue to rise locally and globally, which is related a concurrent rise in medical and economic costs. Previous literature has not comprehensively discussed the association of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects. Such information is valuable in predicting future health-related risks and formulating interventions to slow the disabling process. Hence, the study aims to estimate the association of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life.

- ***Objective***

To determine the association of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects.

- ***Methods***

62 subjects were recruited based on inclusion criteria and divided into five different weight-for-height index categories. Six measures of physical fitness (waist-hip ratio, hand grip strength, 30-second chair stand test, modified push-up test, 2-minute walk test, chair sit and reach test) were measured. Physical Fitness Index was calculated as the mean of these six fitness test scores and gait speed was analyzed using a 10-meter walk test and health-related quality of life using the SF-12 questionnaire.

- ***Result and Discussion***

The bivariate analysis showed a decreasing trend in physical fitness, gait speed, and health-related quality of life across the weight-for-height index categories. All variables showed a significant inverse relation (p<.05) with the weight-for-height index.

The results may be due to the increased presence of type II muscle fibers and adiposity in higher weight-for-height index which might cause a detrimental impact on physical fitness. Excess adipose tissue modifies the ideal ratio of fat and fat-free mass, as well as the quality and function of skeletal muscle. The above might have implied an overall negative effect on gait speed and health-related quality of life.

➤ ***Conclusion***

The study observed an association between weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects.

Keywords: *Weight-For-Height Index; Health-Oriented Physical Fitness; Physical Fitness Index; Gait Speed; Health-Related Quality of Life; Middle-Aged Subject.*

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I. INTRODUCTION

Weight-for-height index, often known as body mass index, is used to classify overweight and obesity in adult.[1] It is most often used to evaluate weight-related health risks.[2]

Obesity is now recognized as one of the most significant public health problems confronting the globe today.[3] The recently conducted National Family Health Survey shows that the number of obese individuals in Kerala is on the rise, both in the female and male populations. For women, the obesity rate in Kerala is 38.1% and for men is 36.4%.[4] There is a great risk that between 2010 and 2040, the incidence of overweight will more than double among Indian people aged 20 to 69, while the prevalence of obesity will treble.[5]

According to research, the quick shift in dietary and physical activity habits may be responsible for the rise in obesity.[6] Obesity, physical inactivity, and poor physical fitness all contribute to the growing prevalence of chronic diseases.[7] The decrease in physical activity may result in decreased health-oriented physical fitness. Health-oriented physical fitness is a broad term used to define the ability to do physical work. Performing physical work necessitates cardiorespiratory functioning, muscular strength, endurance, and musculoskeletal flexibility. Many other factors influence it, overall body fat and socioeconomic status.[8] Studies says that “the underweight, overweight, and obesity statuses were significantly associated with slow self-selected gait speed for both genders.”[9] Gait speed is used as a performance-based measure of physical function which can predict the future occurrence of disability and dependence on everyday tasks.[10]

Even though obesity rates continue to increase locally and globally, studies have not yet comprehensively evaluated the health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects across the various BMI categories. So, it is important to comprehensively evaluate health-oriented physical fitness indices over the complete range of variations in BMI in middle-aged subjects which will help to design more targeted and appropriate interventions to proactively deal with the disabling process in senility. Hence, the study aims to estimate the relationship of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects. Such information will help to predict the health-related risks.

II. MATERIALS AND METHODS

A six-month analytical cross-sectional study was conducted using convenience sampling technique to determine the association of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in inactive and minimally active middle-aged subjects. After obtaining clearance from the Scientific Committee and Institutional Review Board, middle-aged subjects fulfilling the inclusion criteria were recruited. The subjects were divided into 5 groups underweight, normal, overweight, pre-obese, and obese based on Asian BMI criteria. Health-oriented physical fitness was assessed using five parameters, body composition was measured using waist-hip ratio, aerobic capacity was measured using a 2-minute walk test, muscular strength was assessed using hand grip strength, 30 seconds chair stand test, endurance was evaluated using a modified push-up test and flexibility was assessed with chair sit and reach test. Physical Fitness Index(PFI) was calculated as the mean of these six fitness test scores, gait speed was analyzed using 10MWT, and health-related quality of life was scaled using the SF-12 questionnaire.

➤ *Procedure*

Each subjects were screened for their BMI categories and asked to do the six health-oriented physical fitness tests, 10-meter walk test to assess gait speed and SF 12 questionnaire to scale the health-related quality of life.

III. RESULTS

The obtained data was analyzed using IBM SPSS 20.00 version. Baseline homogeneity was established using the Test of linearity as the sample size was 62. Descriptive statistics were used to present the baseline characteristics of the data. All quantitative variables were presented as mean and standard deviation and qualitative variables as frequency and percentages. Bivariate analysis was done. A p-value less than 0.05 was considered as statistically significant. Regression coefficient (β) was categorized as follows: 0.00 – 0.20: Negligible, 0.21 – 0.50: Weak, 0.51 -0.80: Moderate, 0.81 – 1.00: Strong. Correlation coefficient (R_S) were categorized as follows 0.00-0.19: very weak, 0.20-0.39: weak, 0.40-0.69: moderate, 0.70-0.89: strong, 0.90-1.00: very strong.

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The baseline normality was assessed using Test for Linearity. The statistical analysis of the data showed that all of the variables were normally distributed. Thus regression was used for the analysis.

In the study the mean value of age, and BMI is 49.35 and 26.62 respectively. In this study, Physical Fitness Index(PFI) was calculated as the mean of the six fitness tests scores and gait speed was assessed using 10MWT and health-related quality of life using SF-12 questionnaire. The results from our study supports the finding that, there is a strong association between BMI and health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects.

Regression analysis was performed to determine the association between BMI and health-oriented physical fitness in middle-aged subjects. The table value is 2.000 and the calculated value is -5.702, which is greater than table value ($p<0.05$, DoF= 61). Hence, rejecting the null hypothesis(H_{01}) and accepting the alternative hypothesis (H_{A1}). There is an association between weight-for-height index and health-oriented physical fitness in middle-aged subjects.

Regression analysis was performed to determine the association between BMI and gait speed in middle-aged subjects. The table value is 2.000 and the calculated value is -3.688, which is greater than table value ($p<0.05$, DoF= 61). Hence rejecting the null hypothesis(H_{02}) and accepting the alternative hypothesis (H_{A2}). There is an association between weight-for-height index and gait speed in middle-aged subjects.

The regression coefficient β value for BMI and SF-12 PCS is -.592. The negative value of β indicated an inverse relation between the weight-for-height index and SF-12 Physical component score. The value of regression coefficient β is between 0.51-0.80 which indicates a moderate direct relationship between weight-for-height index and SF-12 PCS. The β value for BMI in relation to SF-12 MCS is -.239. The negative value of β indicated an inverse relationship between the 2 variables. The value of β is between 0.21- 0.50 which indicates a weak inverse relationship between weight-for-height index and SF-12 MCS.

Regression analysis was performed to determine the relationship of weight-for-height index and health-related quality of life in middle-aged subjects. The table value is 2.000 and the calculated values of t was 5.690 (SF-12 PCS) and 22.546 (SF-12 MCS), which is greater than table value ($p<0.05$, DoF=61). Hence, rejecting the null hypothesis(H_{03}) and accepting the alternative hypothesis (H_{A3}). There is an association between weight-for-height index and health-related quality of life in middle-aged subjects.

Regression analysis was performed to determine the association between weight-for-height index and components of Heath-related physical fitness in middle-aged subjects. The regression coefficient β value for BMI and body composition is .511. The positive value of β indicated a direct relation between the weight-for-height index and body composition. The value of regression coefficient β is between 0.51-0.80 which indicates a moderate direct relationship between weight-for-height index and body composition.

The β value for BMI in relation to upper extremity strength is -.319. The negative value of β indicated an inverse relationship between the 2 variables. The value of β is between 0.21- 0.50 which indicates a weak inverse relationship between weight-for-height index and upper extremity strength. The β value for BMI in relation to lower extremity strength is -.359. The negative value of β indicated an inverse relationship between the 2 variables. The value of β is between 0.21- 0.50 which indicates a weak inverse relationship between weight-for-height index and lower extremity strength.

The regression coefficient β value for BMI and muscle endurance is -.503. The negative value of β indicated an inverse relation between the weight-for-height index and muscle endurance. The value of regression coefficient β is between 0.51-0.80 which indicates a moderate direct relationship between weight-for-height index and muscle endurance.

The regression coefficient β value for BMI and aerobic capacity is -.548. The negative value of β indicated an inverse relation between the weight-for-height index and aerobic capacity. The value of regression coefficient β is between 0.51-0.80 which indicates a moderate direct relationship between weight-for-height index and muscle capacity.

This implies that the body composition increases by 26%, and there was 25% decreasing trend in muscle endurance,30% in aerobic capacity and 11% in muscle strength.

Correlation between flexibility and BMI show weak positive association with coefficient 0.305. This shows a significant ($p<0.05$) association between flexibility and weight-for-height index. As the scores of chair sit and reach test increases, the flexibility decreases across the increasing BMI.

Regression analysis was performed to determine the association between weight-for-height index and Heath-related physical fitness based on physical activity in middle-aged subjects. The regression coefficient β value for BMI and health-oriented physical fitness for inactive middle-aged subjects is -.531. The negative value of β indicated an inverse relation between the weight-for-height index and health-oriented physical fitness for inactive middle-aged subjects. The value of regression coefficient β is between 0.51-0.80 which indicates a moderate direct relationship between weight-for-height index and health-oriented physical fitness.

The β value for BMI in relation to health-oriented physical fitness in minimally active middle-aged subjects is -.471. The negative value of β indicated an inverse relationship between the 2 variables. The value of β is between 0.21- 0.50 which indicates a weak inverse relationship between weight-for-height index and health-oriented physical fitness. This

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implies that, there was a 28% of decreasing trend of physical fitness in inactive subjects and 22% in minimally active subjects.

Thus from the obtained results it can be inferred that there is an association of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects.

Table 1: Demographic Representation of Age

Age	Frequency	Percentage
44-48	24	38.70%
49-54	38	61.29%
Total	62	100%

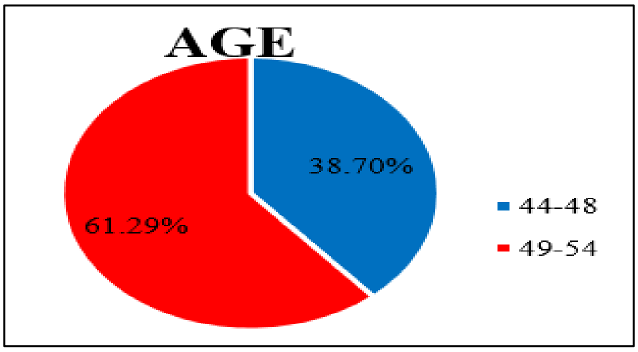


Fig 1: Demographic Representation of Age

Table 2: Demographic representation of gender

Gender	Frequency	Percentage
Male	20	32.2%
Female	42	67.7%
Total	62	100%

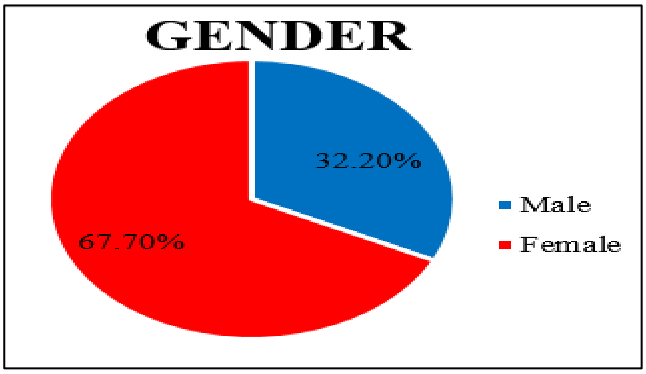


Fig 2: Graphical Representation of Gender Distribution

Table 3: Demographic Representation of Physical Activity

Physical Activity	Frequency	Percentage
Inactive	29	46.77%
Minimally active	33	53.32%

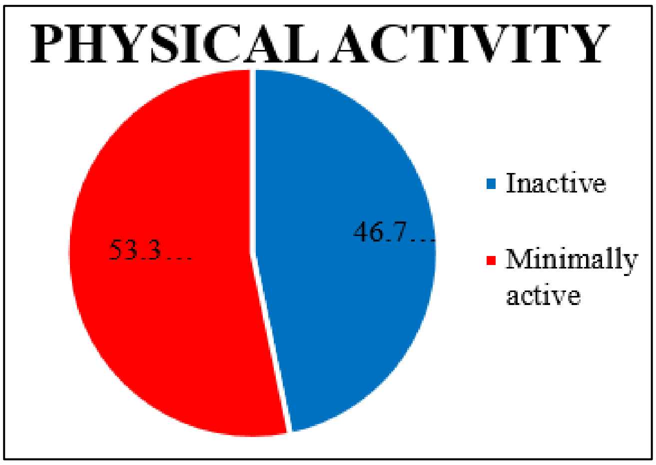


Fig 3: Graphical Representation of Physical Activity

Table 4: Demographic Representation of BMI

BMI	Frequency	Percentages
Normal	12	19.35%
Overweight	14	22.58%
Pre-obese	21	33.87%
Obese	15	24.19%

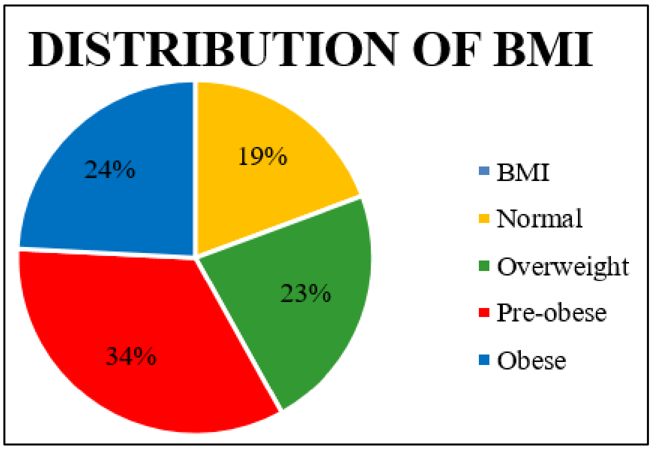
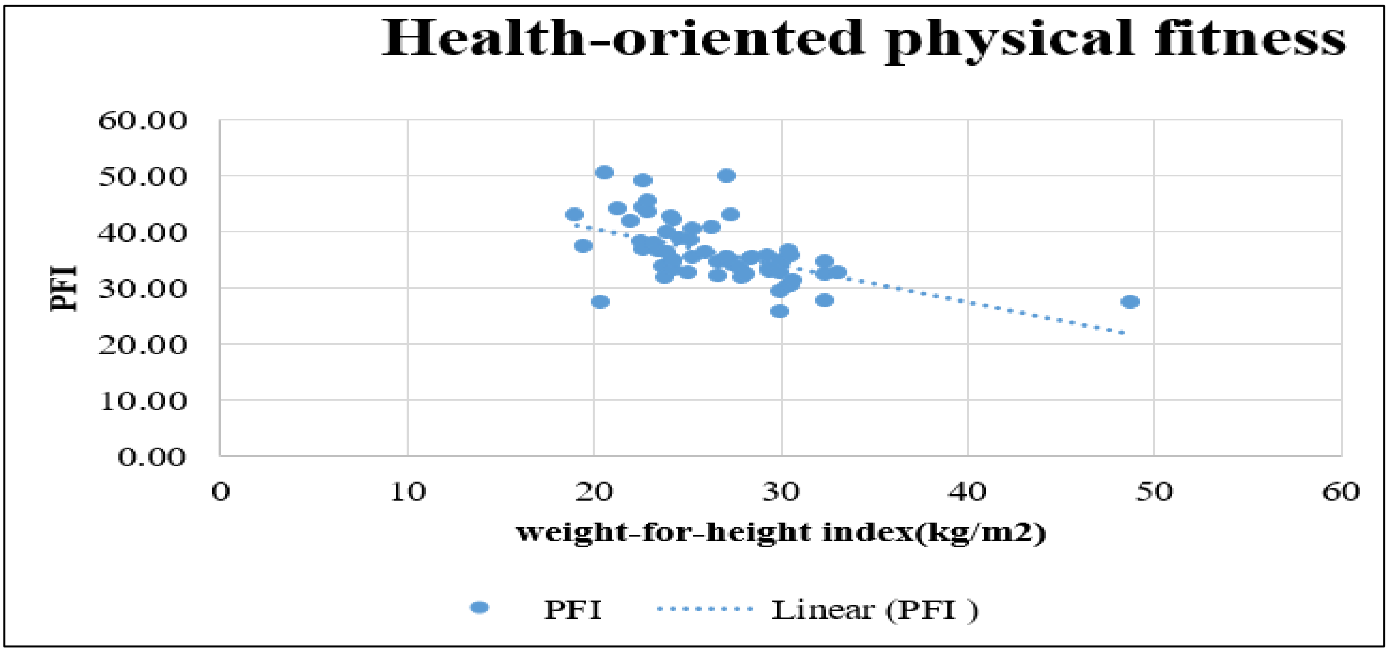


Fig 4: Demographic Distribution of BMI

Table 5: Regression Analysis of Physical Fitness Index on Weight-for-Height Index

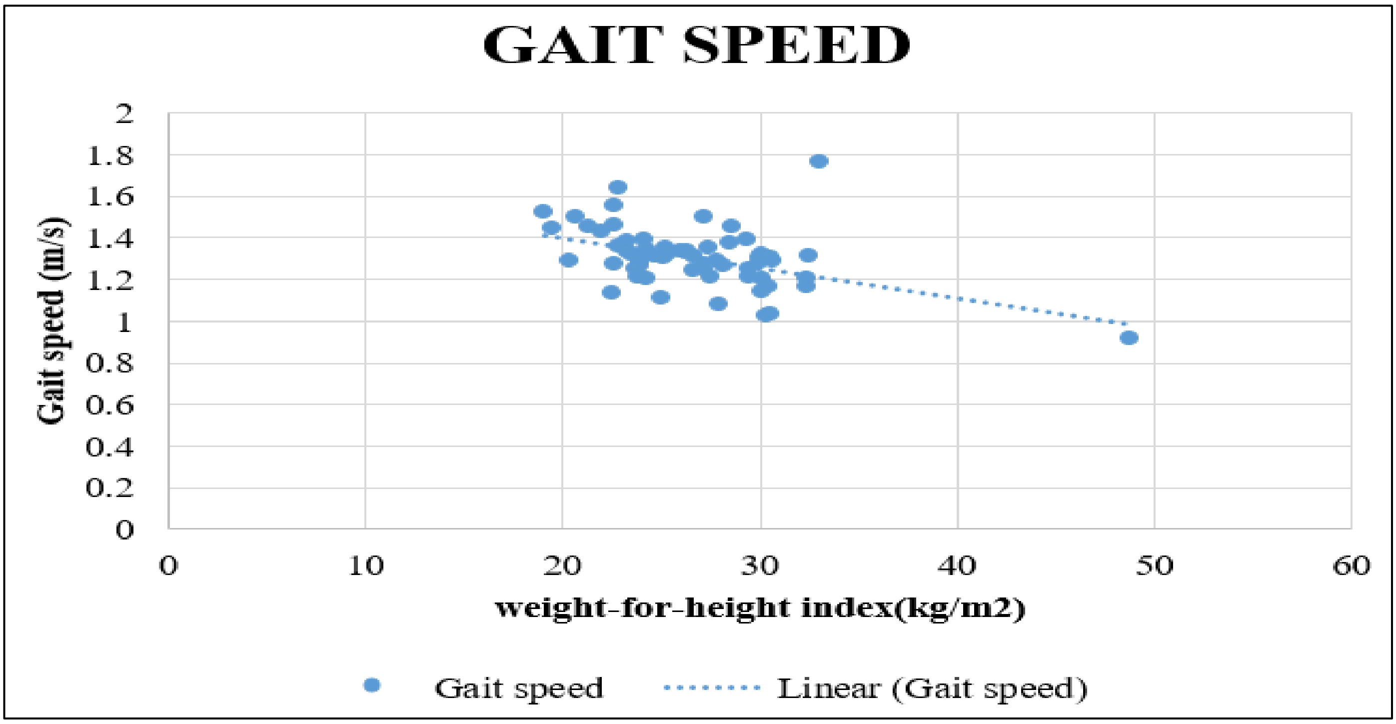
Linear Regression Model	Standardized Coefficients Beta(β)	t	Sig.
Physical Fitness Index	-.593		
Weight-for-Height Index		-5.702	.000



Graph 1: Regression Analysis of Physical Fitness Index on Weight-for-Height Index

Table 6: Regression Analysis of Gait Speed on Weight-for-Height Index

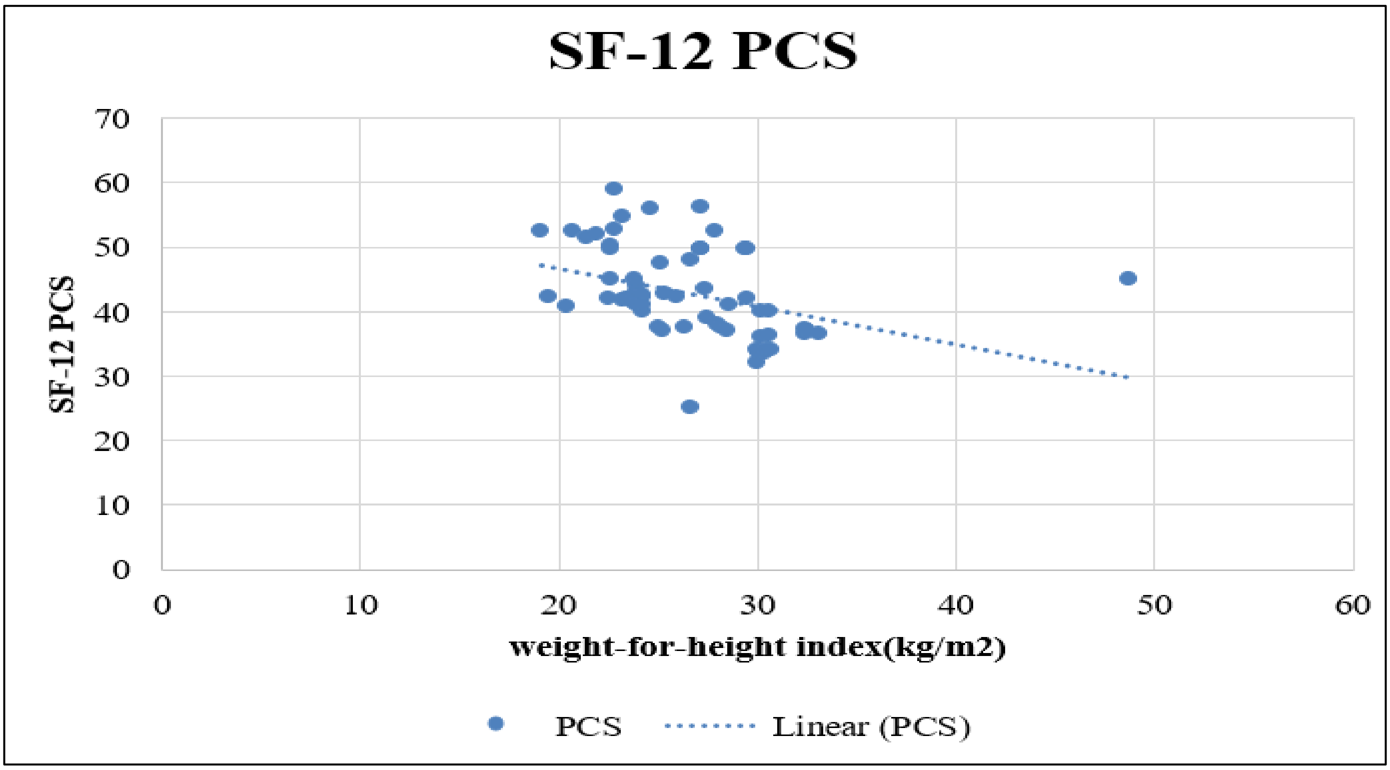
Linear Regression Model	Standardized Coefficients	t	Sig.
	Beta		
Gait speed	-.430	-3.688	.000
weight-for-height index			



Graph 2: Regression Analysis of Gait Speed on Weight-for-Height Index

Table 7: Regression Analysis of SF-12 PCS on Weight-for-Height Index

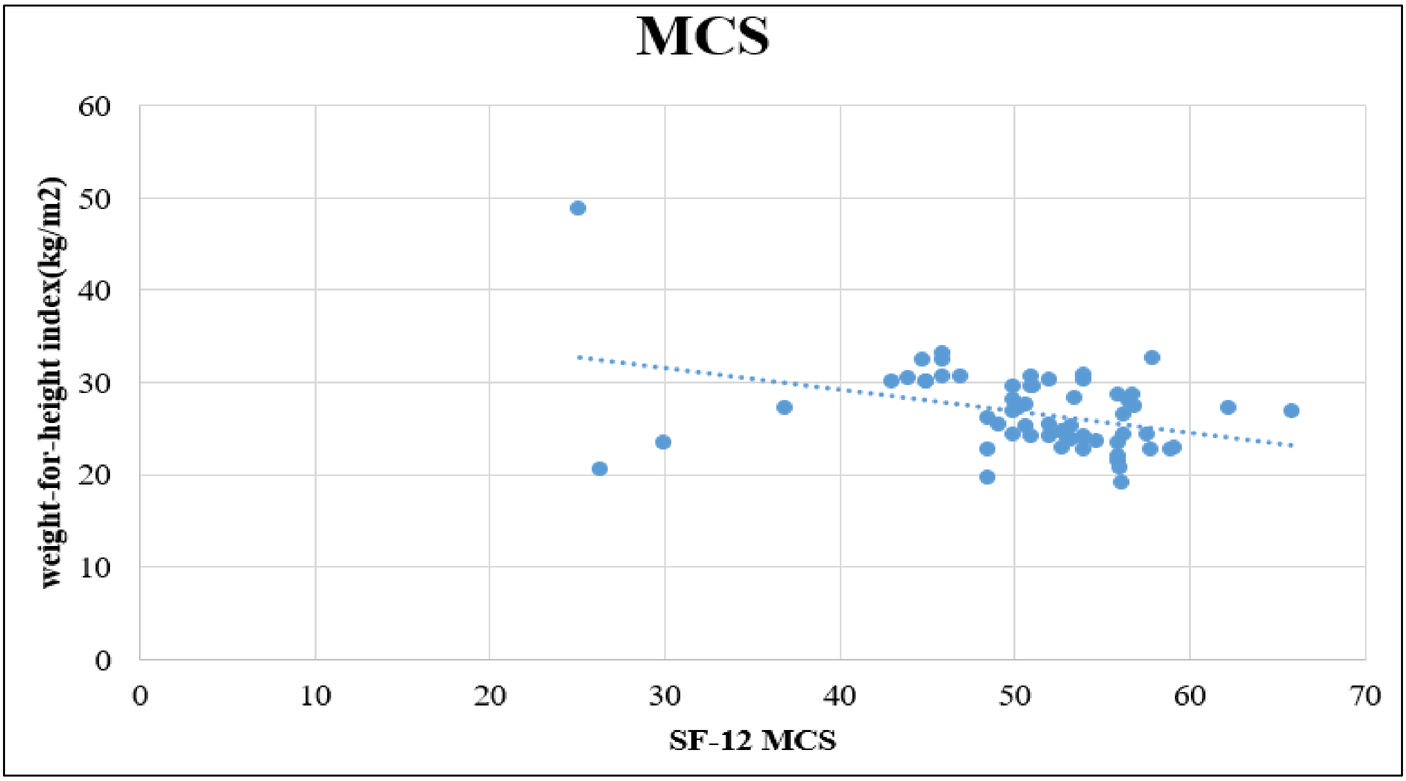
Linear Regression Model	Standardized Coefficients	t	Sig.
	Beta		
SF-12 PCS	-.592	27.419	.000
weight-for-height index		-5.690	.000



Graph 3: Regression analysis of SF-12 PCS on weight-for-height index

Table 8: Regression Analysis of Weight-for-Height Index on SF-12 MCS

Linear Regression Model	Standardized Coefficients	t	Sig.
	Beta		
SF-12 MCS			
Weight-for-height index	-.239	22.546	.000



Graph 4: Regression Analysis of Weight-for-Height Index on MCS

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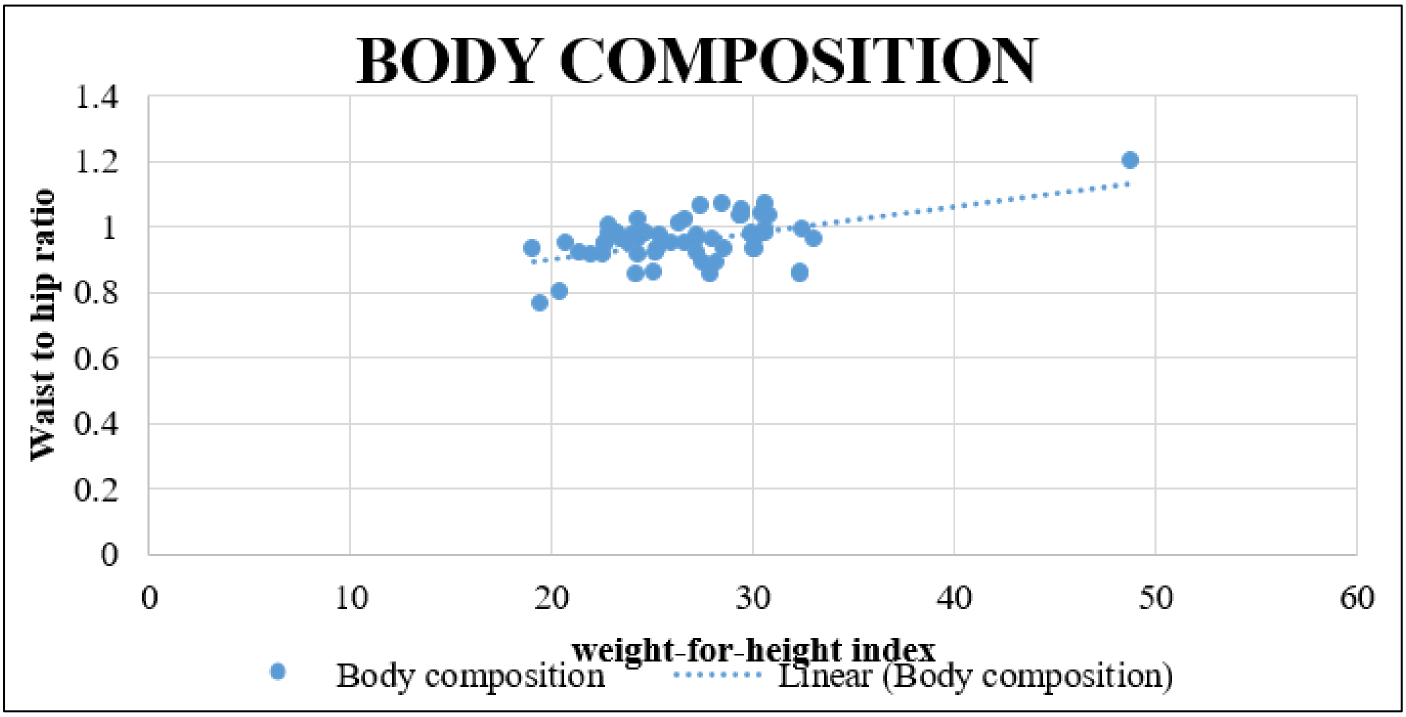
Table 9: Regression Analysis of Body Composition on Weight-for-Height Index

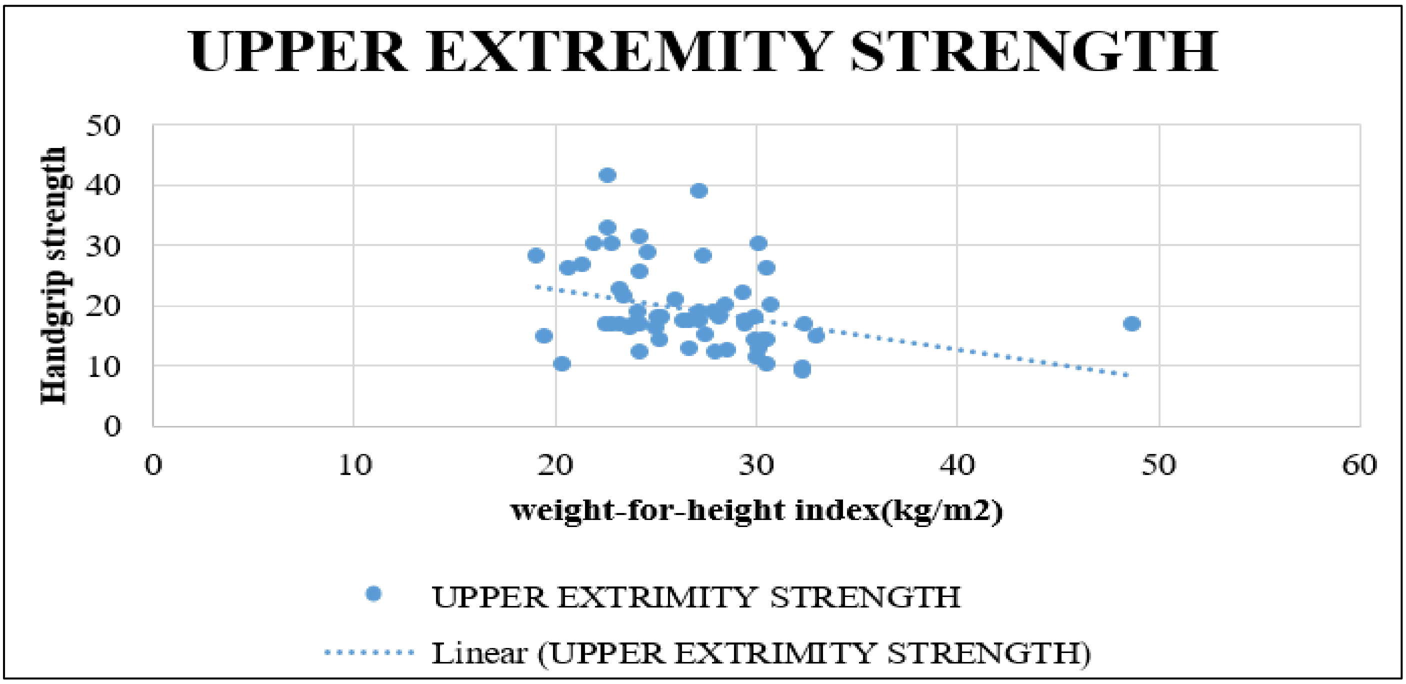
Linear Regression Model	Standardized Coefficients Beta(β)	t	Sig.
Body Composition Weight-for-height index	.511	4.451	.000



Graph 5: Regression Analysis of Body Composition on Weight-for-Height Index

Table 10: Regression Analysis of Upper Extremity Strength on Weight-for-Height Index

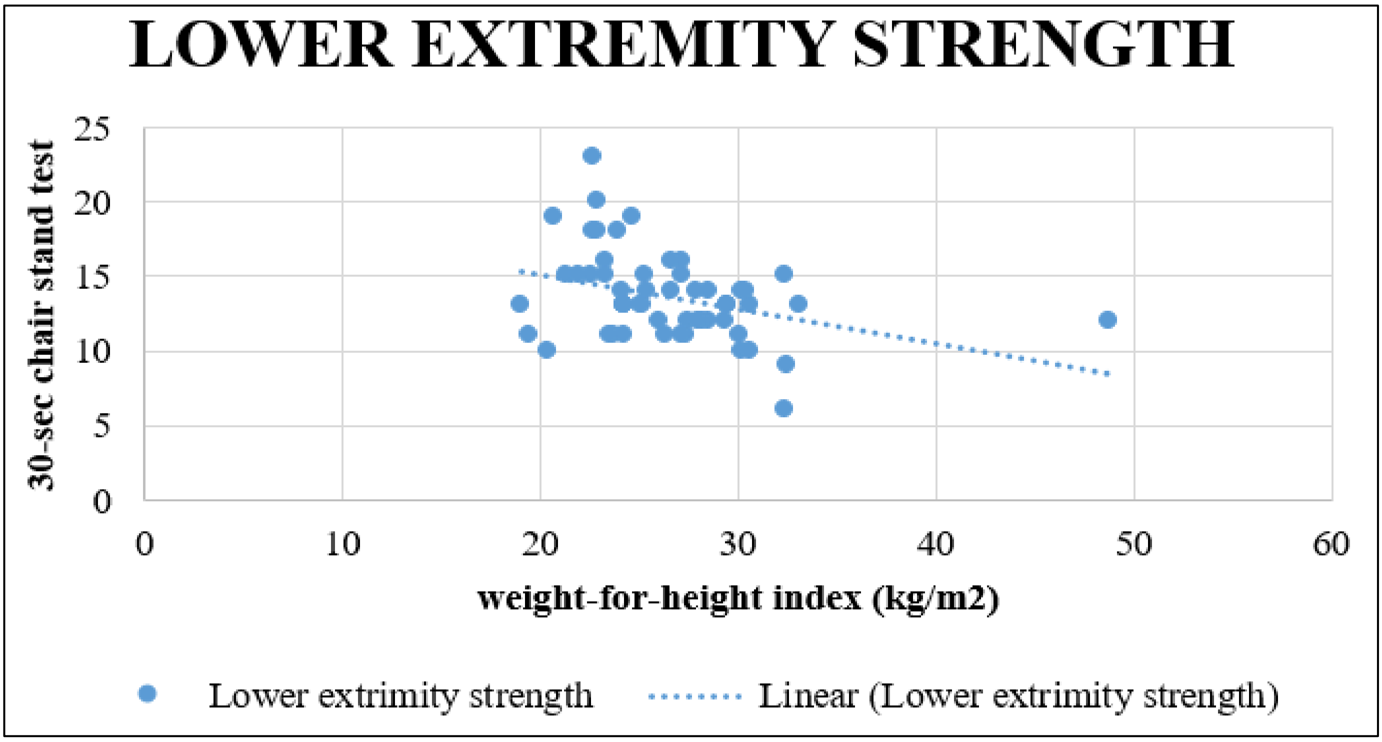
Linear Regression Model	Standardized Coefficients Beta(β)	t	Sig.
Upper extremity strength Weight-for-height index	-.319	2.514	.015



Graph 6: Regression Analysis of Upper Extremity Strength on Weight-for-Height Index

Table 11: Regression Analysis of Lower Extremity Strength on Weight-for-Height Index

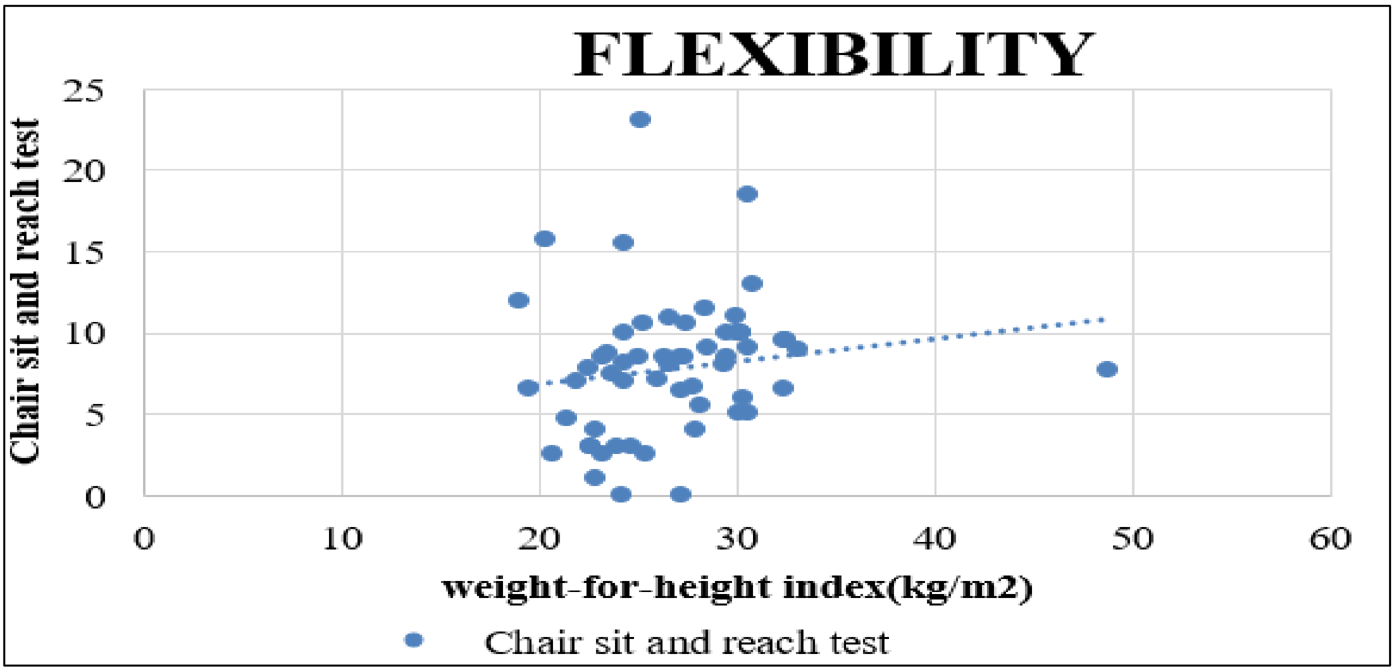
Linear Regression Model	Standardized Coefficients Beta(β)	t	Sig.
Lower extremity strength			
Weight-for-height index	-.359	-2.879	.006



Graph 7: Regression Analysis of Lower Extremity Strength on Weight-for-Height Index

Table 12: Correlation of Flexibility and Weight-for-Height Index

Type of correlation	Variables	Coefficient	N
Spearman's rho	Flexibility Weight-for-height index	.305	62



Graph 8: Correlation Analysis of Flexibility and Weight-for-Height Index

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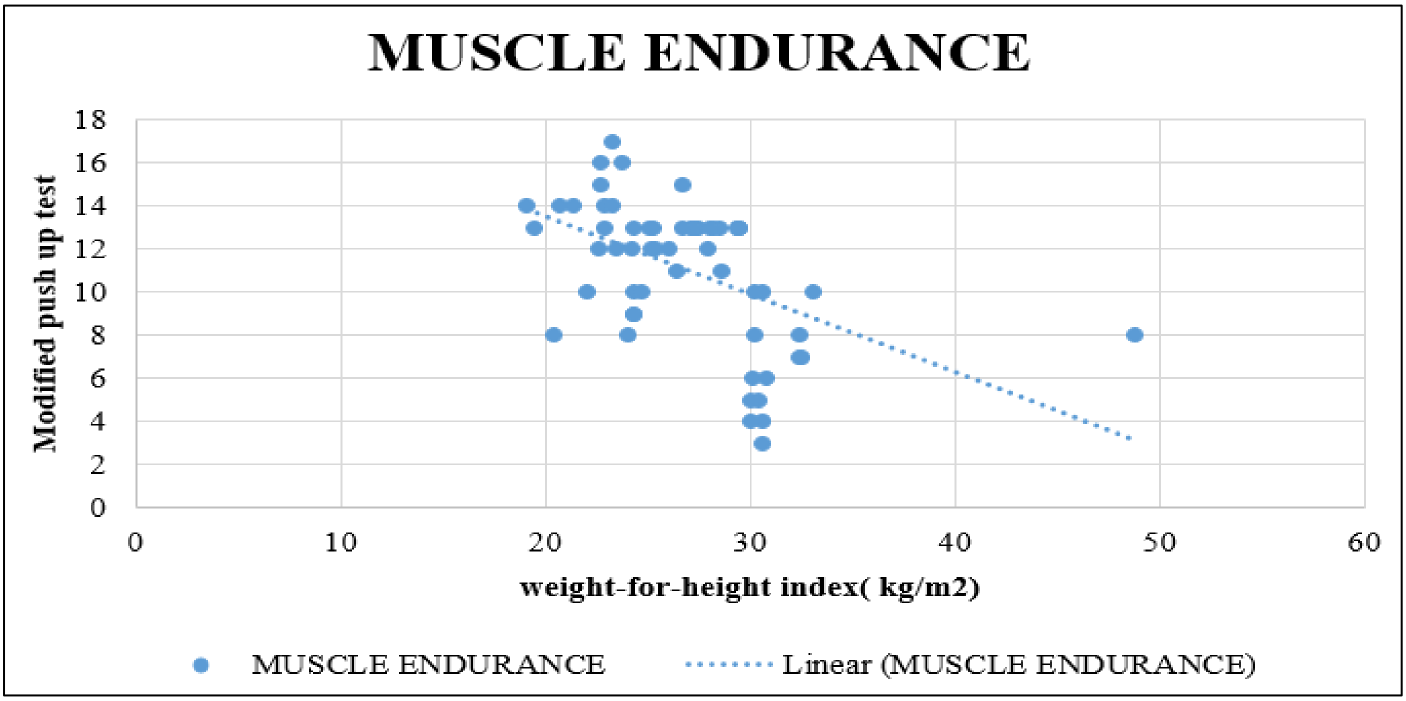
Table 13: Regression Analysis of Muscle Endurance on Weight-for-Height Index

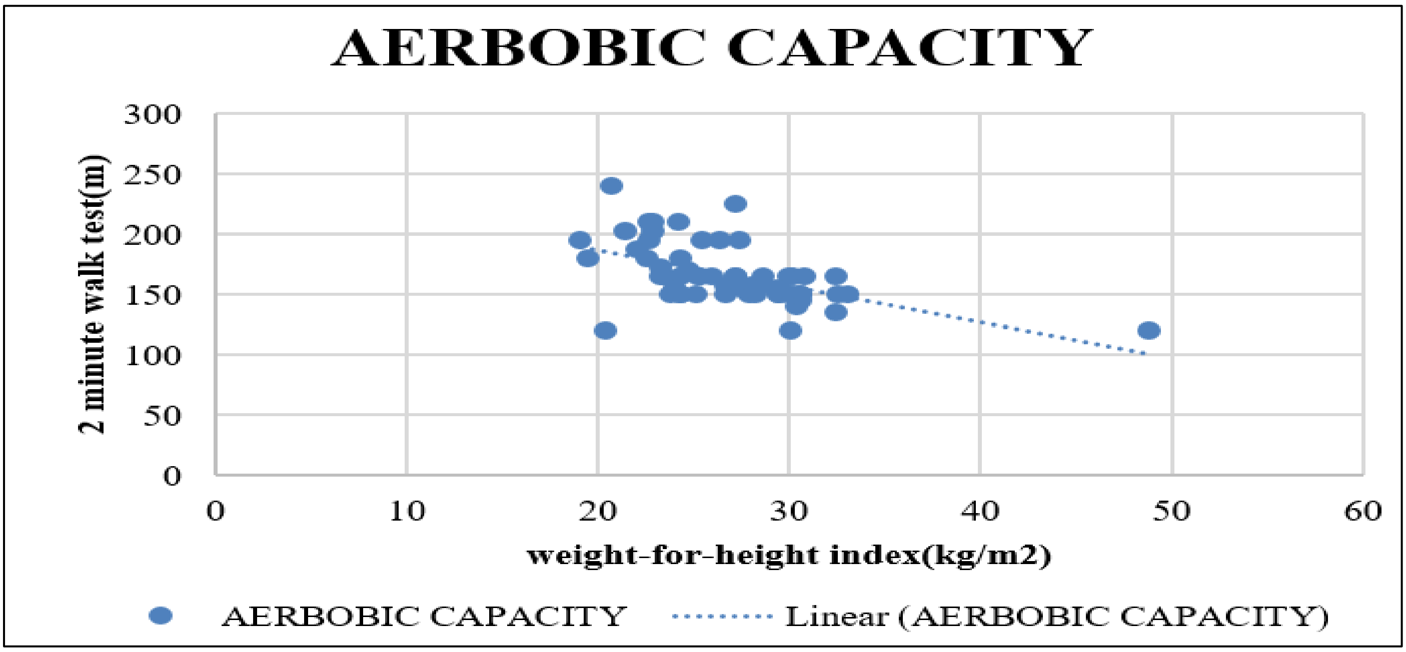
Linear Regression Model	Standardized Coefficients Beta(β)	t	Sig.
Muscle endurance Weight-for-height index	-.503	-4.355	.000



Graph 9: Regression Analysis of Muscle Endurance on Weight-for-Height Index

Table 14: Regression Analysis of Aerobic Capacity on Weight-for-Height Index

Linear Regression Model	Standardized Coefficients Beta(β)	t	Sig.
Aerobic capacity Weight-for-height index	-.548	-4.897	.000



Graph 10: Regression Analysis of Aerobic Capacity on Weight-for-Height Index

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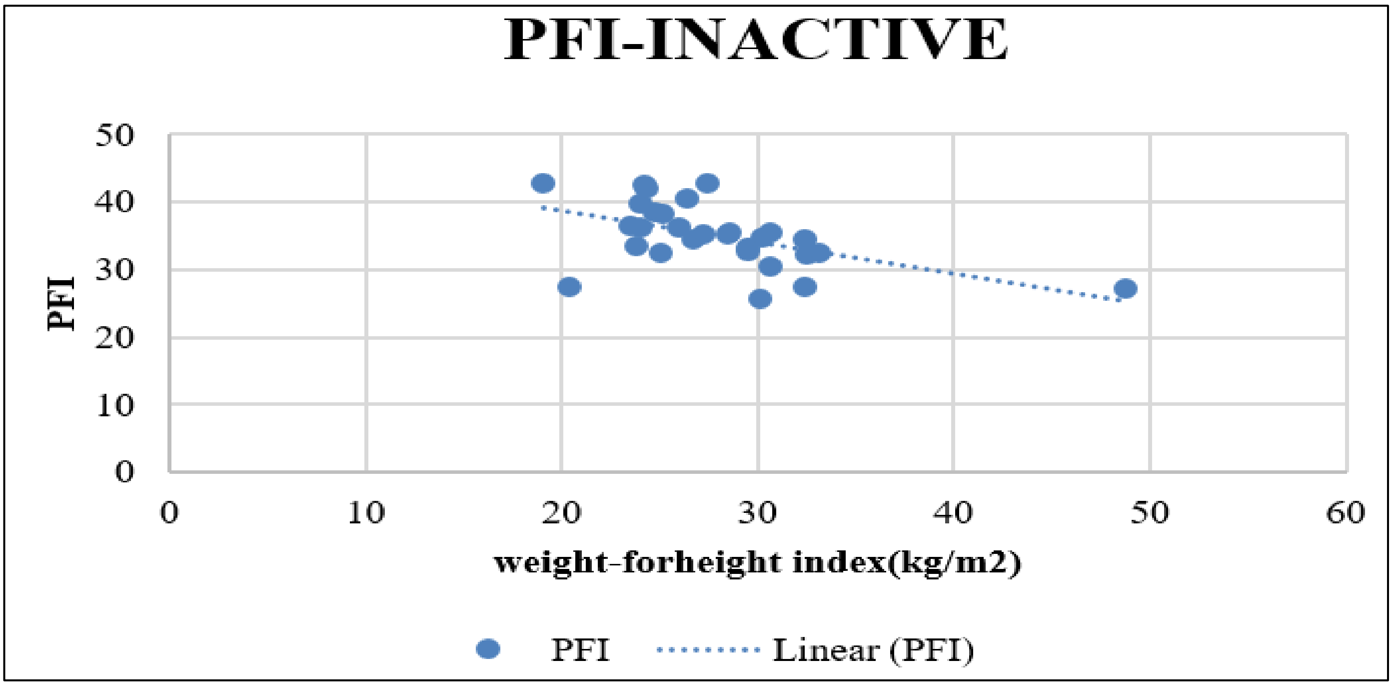
Table 15: Regression Analysis of PFI on Weight-for-Height Index in Inactive Subjects

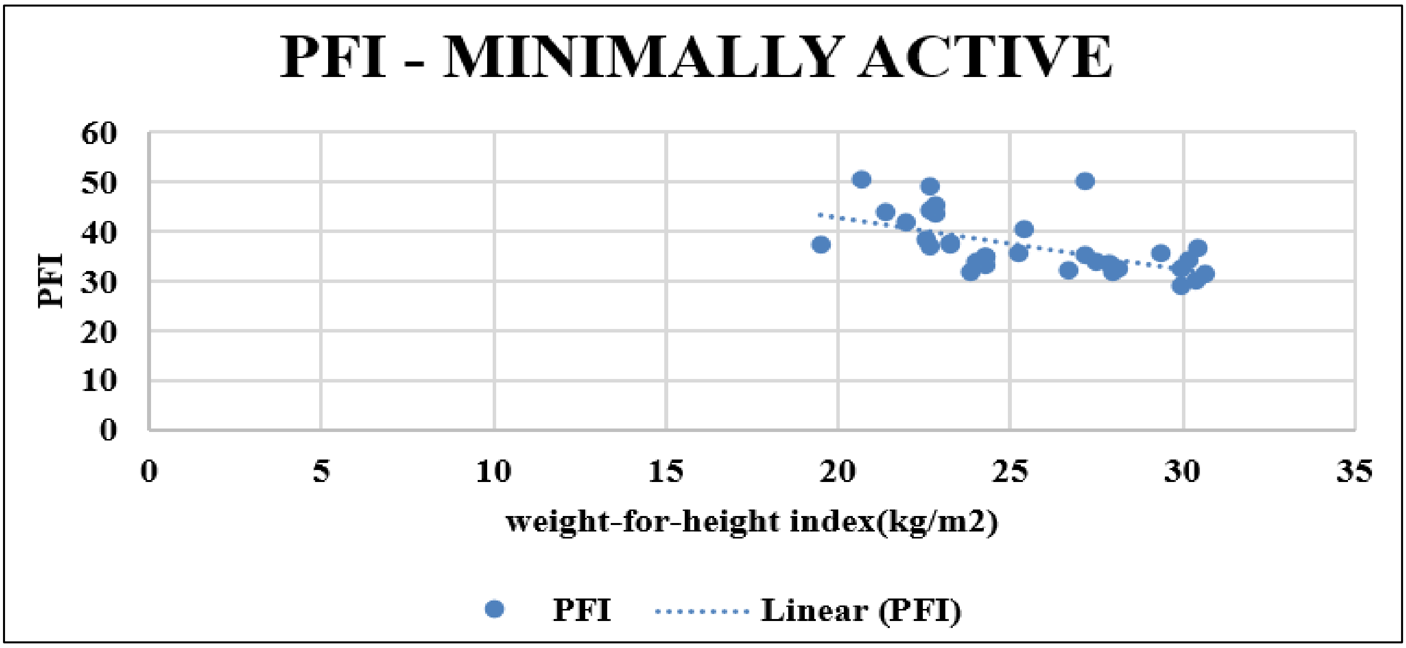
Linear Regression Model	Standardized Coefficients	t	Sig.
	Beta		
PFI	-.531	-3.255	.003
Weight-for-height index			



Graph 11: Regression Analysis of PFI on Weight-for-Height Index

Table 16: Regression Analysis of Health-Oriented Physical Fitness on Weight-for-Height Index in Minimally Active Subjects

Linear Regression Model	Standardized Coefficients	t	Sig.
	Beta		
PFI			
Weight-for-height index	-.471	-2.668	.013



Graph 12: Regression Analysis of PFI on Weight-for-Height Index in Minimally Active Subjects

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IV. DISCUSSION

The purpose of the study was to determine the association of weight-for-height index with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects. Subjects were recruited based on the inclusion criteria. They were divided into 5 groups namely underweight, normal, overweight, pre-obese, and obese based on Asian BMI criteria. The outcome tools used were health-oriented physical fitness, gait speed, and health-related quality of life.

The baseline parameters considered in the study were age, gender, physical activity, and BMI. The age category ranged from 44 to 54 years with a mean of 49.35. Out of 62 subjects, 20 were males and 42 were females. In the sample studied, 29 subjects were minimally active and 33 were inactive according to IPAQ-SF. Among the subjects, 12 were normal BMI, 14 overweight, 21 were pre-obese, and 15 were obese which implies that the majority of subjects were pre-obese and obese. The study findings showed that, among the middle-aged subjects, the weight-for-height index was associated with health-oriented physical fitness, gait speed, and health-related quality of life. Bivariate analysis of all variables showed an inverse relation to the weight-for-height index.

In the study, Physical Fitness Index(PFI) was calculated as the mean of the six fitness test scores. As the weight-for-height index increases there is a proportionate reduction in the Physical Fitness Index, which signifies a downturn in Health-oriented physical fitness across the different categories of weight-for-height index. Middle-aged subjects with normal BMI generally showed greater PFI than overweight, pre-obese, and obese subjects. Abnormal weight status showed a visible alleviation in the components of health-oriented physical fitness especially in aerobic capacity by 30%, muscle endurance by 25%, and muscle strength by 11%. The study found a 28% decreasing trend in physical fitness among inactive subjects and 22% among minimally active, which may cause a pronounced negative effect on physical fitness.

The study also found that there was an increase in body composition by 26% which is in parallel with other studies that proved adiposity is consistently associated with poor physical performance and physical function. Studies show that 'a high-calorie diet and sedentary lifestyle result in higher lipogenic activity in mesenteric fat tissues than in subcutaneous fat and other areas of the body. This portion of the body is metabolically very active and could have a continual uptake of fat than any other part of the body.'[11] Evidence suggests that abdominal obesity is a stronger predictor of cardiovascular risk where, people with a high percentage of body fat have higher rates of morbidity and mortality.[12,13,14] Studies says that, 'in obese individuals, there is increase in type II muscle fibers and decrease in type I muscle fibers which may have effect on reduced oxygen uptake.'[15] This may be the reason for reduced muscle endurance in higher BMI categories.

Higher levels of BMI are linked to an increased likelihood of developing a functional disability. The reduction in muscle strength may be due to the increased deposition of the adipose tissue, as it is an endocrine organ which secrets numerous hormones and inflammatory cytokines, hence enhancing biochemical stress.[16] As obese individuals store chronically high levels of adipose tissue, which causes an increase in circulating pro-inflammatory cytokines, such as TNF-α which can cause a detrimental impact on skeletal muscle by activating muscle protein degradation that may cause muscle wasting and reduced muscle protein synthesis.[17] In addition, reduced muscular strength may be caused by decreased mobility and changes in muscle structure, which are known to be strongly and independently associated with walking speed, mobility tasks, and physical performance.[18]

The increase in the weight-for-height index also impairs flexibility, which is connected to postural abnormalities exacerbated by a sedentary lifestyle and biological ageing. The restricted joint ranges can also be due to bulky fascia.[19]

The study explored the patterns of gait speed across the different weight-for-height index levels and found an inverse relationship between the weight-for-height index and gait speed indicating a proportionate reduction in gait speed with varying levels of BMI. Cesari et al[20] and Dufour et al[21] found that individuals with higher levels of BMI may become slow walkers due to increased balance impairment and physical fatigue, thus more vulnerability to negative outcomes. Obesity, strength, and physical activity were all risk factors for incident slow gait.[22] Furthermore, several longitudinal studies suggest a link between BMI and gait speed.[6,23-27] Both obesity and muscle impairment negatively affect health and physical functioning.[28]The study's findings are partially consistent with prior reports, but they contribute to the body of knowledge about middle-aged subjects gait speeds. The excess adipose tissue may alter the ideal ratio of fat and fat-free mass and impact the quality and function of skeletal muscle, which can be the cause of decreasing gait speed across BMI levels.[6]

The results of the study show that there is an inverse relation between weight-for height index and HRQOL. Obese middle-aged patients had considerably lower total scores for both mental and physical components. The reduction in the various components of health-oriented physical fitness may have negatively affected the physical domain. The results are in agreement with previous reports that quality of life is impaired as expected in obese in comparison with normal BMI.[29] In general, the lower scores on the MCS and the PCS indicated greater disability. In parallel with other studies, the results of the study showed more impairment of the physical than the mental component of the SF-12 questionnaire which suggests the presence of disability in middle-aged subjects.

The present study also revealed a significantly increasing trend of overweight and pre-obese in the study population. When compared to normal BMI, the other categories showed a decrement in all the variables.

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It is evident that health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects are associated with BMI trajectory.

➢ *Limitations*

Underweight subjects were not obtained and therefore it was not included in the BMI categories.

V. CONCLUSION

The purpose of the study was to find the association of BMI with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects. The study found an inverse association between BMI and health-oriented physical fitness, gait speed, and HRQOL. As BMI increases there was a proportionate reduction in all outcome variables. The study concluded that there is an association of BMI with health-oriented physical fitness, gait speed, and health-related quality of life in middle-aged subjects. The findings of the study highlight the need to proactively design intervention.

SUGGESTIONS FOR FUTURE STUDIES

➢ *Future Studies can be Done:*

- To analyze both genders separately
- To find the impact of body composition on health-oriented physical fitness, gait speed, and HRQOL in various BMI categories separately
- To find the impact of exercise interventions on health-oriented physical fitness, gait speed, and HRQOL in various BMI categories separately

LIST OF ABBREVIATIONS

- 10MWT: 10 meter Walk Test
- 2MWT: 2 minute Walk Test
- 30 CST: 30 Second Chair Stand Test
- BMI: Body Mass Index
- CSR: Chair Sit and Reach
- HGS: Hand Grip Strength
- HRQOL: Health-Related Quality of Life
- IPAQ-SF: International Physical Activity Questionnaire-Short Form
- MCS: Mental Component Score
- PCS: Physical Component Score
- PFI: Physical Fitness Index
- SF-12: 12-Item Short Form Survey
- TNF-α: Tumor Necrosis Factor-Alpha
- WHO: World Health Organization
- WHR: Waist-Hip Ratio

AUTHOR CONTRIBUTIONS

The author's confirmed contribution to the paper as follows: Study conception and Design: Athulya John and Rejimol Jos Pulicken; Data Collection: Athulya John; Review and Editing: Jisha Thampi, Anumol C and Rakhi Balagopal; Analysis and Interpretation; Athulya John, Remya N, Manju Unnikrishnan; Draft manuscript: Athulya John and Rejimol Jos Pulicken. All the authors reviewed the results and approved the final version of the manuscript.

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REFERENCES

[1]. Bodymassindex(BMI).Who.int.2022.https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/body-mass-index

[2]. Nguyen P, Scott S, Headey D, Singh N, Tran L, Menon P et al. The double burden of malnutrition in India: Trends and inequalities (2006–2016). PLOS ONE. 2021;16(2): e0247856.

[3]. Caballero B. The Global Epidemic of Obesity: An Overview. Epidemiologic Reviews. 2007;29(1):1-5.

[4]. Ullas.AS. Kerala's obesity rate surpasses national average. https://www.onmanorama.com/news/kerala/2021/11/29/kerala-obesity-rate-surpasses-national-average.html

[5]. Luhar S, Timaeus I, Jones R, Cunningham S, Patel S, Kinra S et al. Forecasting the prevalence of overweight and obesity in India to 2040. PLOS ONE. 2020;15(2): e0229438.

[6]. HU G, Tuomilehto J, Silventoinen K, Barengo N, Jousilaht P. Joint effects of physical activity, body mass index, waist circumference and waist-to-hip ratio with the risk of cardiovascular disease among middle-aged Finnish men and women. European Heart Journal. 2004;25(24):2212-2219.

[7]. Tian Y, Jiang C, Wang M, Cai R, Zhang Y, He Z, et al. BMI, leisure-time physical activity, and physical fitness in adults in China: results from a series of national surveys, 2000-14. Lancet Diabetes Endocrinol. 2016;4(6):487–97.

[8]. Unnikrishnan S. Having potbelly adds to risk of Covid, say experts as NFHS report cites high prevalence of obesity in Kerala. 2022. Available from: https://www.newindianexpress.com/states/kerala/2022/mar/14/having-potbellyadds-to-risk-of-covid-say-experts-as-nfhs-report-cites-high-prevalence-of-obesity-in-kerala-2429783.

[9]. Tabue-Teguo M, Perès K, Simo N, Le Goff M, Perez Zepeda M, Féart C et al. Gait speed and body mass index: Results from the AMI study. PLOS ONE. 2020;15(3): e0229979.

[10]. Shinkai S. Walking speed as a good predictor for the onset of functional dependence in a Japanese rural community population. Age and Ageing. 2000;29(5):441-446.

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[11]. Matsuzawa Y, Shimomura I, Nakamura T, Keno Y, Kotani K, Tokunaga K. Pathophysiology and pathogenesis of visceral fat obesity. Obes Res. 1995;3(S2):187s–94s.
[12]. Suni J, Oja P, Miilunpalo S, Pasanen M, Vuori I, Bös K. Health-related fitness test battery for middle-aged adults: Associations with physical activity patterns. Int J Sports Med. 2007;20(03):183–191.
[13]. Peters D, Fritz S, Krotish D. Assessing the reliability and validity of a shorter walk test compared with the 10 meter walk test for measurements of gait speed in healthy, older adults. journal of geriatric physical therapy. 2013;36(1):24-30.
[14]. Wee C, Davis R, Hamel M. Comparing the SF-12 and SF-36 health status questionnaires in patients with and without obesity. Health and Quality of Life Outcomes. 2008;6(1):11.
[15]. Lumeng CN, Saltiel AR. Inflammatory links between obesity and metabolic disease. Journal of Clinical Investigation. 2011;121(6):2111–7.
[16]. Kelley DE, Thaete FL, Troost F, Huwe T, Goodpaster BH. Subdivisions of subcutaneous abdominal adipose tissue and insulin resistance. American Journal of Physiology-Endocrinology and Metabolism. 2000;278(5).
[17]. Armstrong A, Jungbluth Rodriguez K, Sabag A, Mavros Y, Parker HM, Keating SE, et al. Effect of aerobic exercise on waist circumference in adults with overweight or obesity: A systematic review and meta-analysis. Obesity Reviews. 2022;23(8).
[18]. Laxmi CC, Udaya IB, Vinutha SS. Effect of body mass index on cardiorespiratory fitness in young healthy males. Int J Sci Res Publ. 2014;4(2):1-4.
[19]. Ahima RS, Flier JS. Adipose tissue as an endocrine organ. Trends in Endocrinology & Metabolism. 2000 Oct 1;11(8):327-32.
[20]. Abellan van Kan G, Rolland Y, Andrieu S, Bauer J, Beauchet O, Bonnefoy M, et al. Gait speed at usual pace as a predictor of adverse outcomes in community-dwelling older people an International Academy on Nutrition and Aging (IANA) Task Force. J Nutr Health Aging. 2009;13(10):881–889.
[21]. Dufour AB, Hannan MT, Murabito JM, Kiel petersDP, McLean RR. Sarcopenia definitions considering body size and fat mass are associated with mobility limitations:the Framingham Study. J Gerontol A Biol Sci Med Sci. 2013; 68(2):168–174.
[22]. Verghese J, Wang C, Allali G, Holtzer R, Ayers E. Modifiable risk factors for new-onset slow gait in older adults. J Am Med Dir Assoc. 2016;17(5):421–425.
[23]. Hardy R, Cooper R, Aihie Sayer A, Ben-Shlomo Y, Cooper C, Deary IJ, et al. Body mass index, muscle strength and physical performance in older adults from eight cohort studies: The Halcyon Programme. PLoS ONE. 2013;8(2).
[24]. Lad UP. A study on the correlation between the body mass index (BMI), the body fat percentage, the handgrip strength and the handgrip endurance in underweight, normal weight and overweight adolescents. journal of clinical and diagnostic research. 2013
[25]. Benetti FA, Bacha IL, Junior AB, Greve JM. Analyses of balance and flexibility of obese patients undergoing bariatric surgery. Clinics. 2016;71(2):78–81.
[26]. Rietman ML, van der A DL, van Oostrom SH, et al. The Association between BMI and Different Frailty Domains: A U-Shaped Curve? J Nutr Health Aging. 2018; 22(1):8–15
[27]. Stenholm S, Sainio P, Rantanen T, et al. High body mass index and physical impairments as predictors of walking limitation 22 years later in adult Finns. J Gerontol A Biol Sci Med Sci. 2007; 62(8):859–865.
[28]. Stenholm S, Alley D, Bandinelli S, Griswold ME, Koskinen S, Rantanen T, et al. The effect of obesity combined with low muscle strength on decline in mobility in older persons: results from the In Chianti study. Int J Obes. 2009;33(6):635–644.
[29]. Zoico E, Di Francesco V, Mazzali G, et al. High baseline values of fat mass, independently of appendicular skeletal mass, predict 2-year onset of disability in elderly subjects at the high end of the functional spectrum. Aging Clin Exp Res. 2007; 19(2):154–159.