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Comparing Between the Different Weight Statuses in the Fitness Level of the (9-12) Years-Old Children

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Abstract:

This research aims at identifying the values of differences between the different weight statuses with significance of the value of the Body Mass Index (BMI) in the fitness level of the (9-12) years-old children. The preliminary measurements which represent the measurements of height and weight were conducted on a random sample consisted of elementary stage students from Al-Baha region whose age ranged between (9-12) years-old, and their characteristics were as follows: age (10.61 ± 0.89), weight (35.85 ± 12.41), height (140.51 ± 9.57), BMI (17.84 ± 4.64). The research methodology depended on identifying the relative distribution for the weight statuses of the research. The students were distributed according to the percentile distribution into four different weight statuses which included: underweight, healthy-weight, at risk of overweight, and overweight. A group of physical tests then have been applied on the following physical abilities (fixed maximum strength, transition speed, muscular endurance, muscular ability, flexibility, endurance, agility, compatibility, and balance), also the fitness level was calculated by the total of obtained (t) value by each student regarding the physical abilities of the research, and to calculate the differences between the groups, the one-way analysis of variance (ANOVA) test was used where the findings showed that there were significant differences between the different weight statuses in most of the results of the physical tests in favor to the children with healthy weight. The results also showed significant differences between the different weight statuses in the fitness level in favor to the children with healthy weight in most of the physical abilities, while the results of the effect's extent showed that the variable of 'balance' was the most affected by BMI while the maximum strength was the last ranking in the list of physical abilities according to the effect's extent.

Keywords: *weight status, body mass index, fitness*

Introduction and research problem:

Fitness is one of the important indicators of public health in different age stages of life for adults, adolescents and children. (Myers et al., 2002)

Scientific studies indicate that there is a positive correlation between fitness level and the scientific achievement, physical growth, physical, mental, psychological and social health, also these studies confirm that developed countries are working on improving fitness of individuals within their communities, due to its positive relation with health, personality and texture, and they seek to set foundations, programs and standards for fitness and its development as it is considered one of the most important physical education goals. (Sary and Nourma, 2001) (Emad, 2005) (Emad et al., 2010)

Many international bodies and organizations have endeavored to measure fitness according to the "American Alliance for Health, Physical Education, Recreation and Dance" (AAHPERD) and the "American College of Sports Medicine" (ACSM) in order to improve the way of life and enhance the health status of individuals and the students in particular. (Ziad, 2010)

Hence studying the characteristics of children's physical growth is associated with the characteristics of the society in which they live with its various variables (social – economic – cultural – environmental – etc...), which significantly affect this growth, many scientific studies have addressed the relationship between fitness and its elements and the weight status with significance of BMI, where the results showed decreased rates of fitness and an increase in BMI. (Ortega et al., 2007) (Ortega et al., 2008) (Seryozha et al., 2015) (Juozas et al., 2015)

Scientific studies recommended following up the BMI during childhood, adolescence and youth periods as they relate to health and disease. (Tambalis et al., 2013)

By reviewing the literature related to the field of the current study, the researcher was able to identify some studies which concerned with the relation between BMI and the elements of fitness. The results of these studies showed that there is a significant effect of the physical pattern, standard weight and the connection between them with the level of physical abilities. (Ahmed and Ali, 2008) (Faleh, 2006) (Michand et al., 2002)

Other studies confirmed that the measurements of physical structure, especially the BMI, are significant determinants of motor performance and of the main indicators which are related to health and fitness level, as there is scientific evidence confirms that the physical characteristics, such as body mass and some body lengths and parameters which are almost related to motor performance. (Reilly, 2000) (Hencken, 2004)

However, despite the above mentioned theoretical literature found by the researcher he noticed that the previous studies concerned with the relationship between BMI and some physical abilities of the different ages and various sports activities, but there are no studies concerned with the effect of the weight status with significance of BMI on the elements of fitness and the amount of this effect on the level of fitness, especially among the sample of the Saudi community whose characteristics differ from the other communities of the previous studies, which did not quantitatively indicate the effect of the weight status on the fitness level and the most affected physical abilities by the individual's weight status. From here the researcher attempted to compare between the different weight statuses with significance of BMI in some physical abilities and fitness level for the (9-12) years-old children in Al-Baha region.

Research objectives:

The current research aims to identify:

- The percentile distribution of the weight statuses with significance of BMI for the (9-12) years-old children in Al-Baha .

- The physical characteristics and their levels of the different weight statuses for the (9-12) years-old children in Al-Baha

- The relationship between BMI and the physical abilities and fitness level of the (9-12) years-old children in Al-Baha .

- The significant differences between the different weight statuses regarding the physical abilities and fitness level of the (9-12) years-old children in Al-Baha .

Research questions:

- What is the percentile distribution of the weight statuses with significance of BMI for the (9-12) years-old children in Al-Baha ?

- What are the physical characteristics and their levels of the different weight statuses for the (9-12) years-old children in Al-Baha ?

- What is the relationship between BMI and the physical abilities and fitness level of the (9-12) years-old children in Al-Baha ?

- What are the significant differences between the different weight statuses regarding the physical abilities and fitness level of the (9-12) years-old children in Al-Baha ?

Methods:

- Subjects:

- The research was conducted on a random sample which included elementary school students of Al-Baha , Saudi Arabia who aged between (9-12) years-old, and the total number of the population was (1912) students from (39) schools of Al-Baha according to the statistical program on the website of the General Directorate of Education in Al-Baha (Attachment 1). http://bahaedu.in/vipschool.php

The measurements of height and weight were conducted on a sample consisted of (1487) Saudi students after excluding the non-Saudi students and the students who were not regular while conducting the measurements of the research, the total sample's characteristics were as follow: age (10.61 ± 0.89), weight (35.85 ± 12.41), length (140.51 ± 9.57), BMI (17.84 ± 4.64).

- Measurements Procedures:

- BMI Measurement:

BMI was calculated by dividing the weight in kilograms on the height squared in meters. The weight statuses were classified according to the percentile distribution of the value of BMI as follows: (1) underweight, when the value of BMI is less than the fifth percentile, (2) healthy-weight, when the value of BMI is greater than the fifth percentile and less than the eighty-fifth percentile, (3) at risk of overweight, when the value of BMI is greater than the eighty-fifth percentile and less than the ninety-fifth percentile, (4) overweight, when the value of BMI is greater than the ninety-fifth percentile. (Adeogun et al., 2013) (Cole et al., 1999) (WHO, 1995) (Cole et al., 1990)

By calculating the percentiles of the values of BMI for the overall sample, they were distributed as follows: at the fifth percentile, the value of BMI equals (12.94), at the

eighty-fifth percentile, the value of BMI equals (22.38), and at the ninety-fifth percentile, the value of BMI equals (27.56), according to the outcomes, the relative distribution of the weight statuses of the sample with significance of BMI's percentiles came as follows: the underweight students were (75) with a percentage of (5.04%), the healthy-weight students were (1190) with a percentage of (80.03%), the students who are at risk of overweight were (153) with a percentage of (10.29%), and finally the overweight students were (69) with a percentage of (4.64%).

- Physical abilities and fitness level tests:

Some conditions were taken into consideration before applying the physical tests starting with (1) training the assistants theoretically and practically on the performance of each test and the method of measuring and recording, (2) training the individuals of the sample, dressing them suitable athletic shoes to perform the tests, (3) they must not eat food before the test for at least two hours, (4) they must be committed to the chronological order and the arrangement of the tests as well as regular attendance, and finally (5) each individual performs a trial before recording.

The tests of physical abilities were applied due to its relevance to the individuals' age group of the research sample and the availability of scientific implications of these tests (validity and reliability) – in the scientific literature, where the hand grip test was used to measure the fixed maximum strength (Mohamed Hassanein, 2004), 30m sprint to measure the speed of transition (Mohamed Hassanein, 2004), sit ups (1 min.) to measure the muscle strength endurance of the abdomen muscles, and standing long jump to measure the muscle strength of the legs (Mohamed Hassanein, 2004), stand and reach to measure flexibility (Mohamed Hassanein, 2004), (800m) run-walk to measure the endurance (Mohamed Allawy, Mohamed Radwan, 1994), zig-zag test between the barriers to measure fitness (Mohamed Hassanein, 2004), numbered circles test to measure compatibility (Mohamed Hassanein, 2004), balance beam test to measure the stable balance (Mohamed Hassanein, 2004). The measurements were conducted in a timeline in which (3) tests per-day were applied, taking into consideration the intensity of the required performance in the test and the measured characteristic, where the first day included the measurements of (sit ups (1 min.), (800m) run-walk, and stand and reach), the second day included the tests of (zig-zag test between the barriers, standing long jump, and numbered circles), and the third day included the tests of (30m sprint, hand grip, and balance beam test), respectively, also the fitness level of the individuals of the research sample was calculated by calculating the total (t) value for the physical abilities of each member of the research sample to be the overall index to the fitness level. Attachment (2)

The physical measurements were conducted on the research sample with its four weight statuses, which were chosen randomly according to Steve Thompson's equation. (Thompson, 2006) (Thompson et al., 1996)

The total size of the sample consisted of (523) students who represent the four weight statuses, and their characteristics were as follows: underweight (n = 63, age = 10.20 ± 0.68 years), healthy-weight (n = 291, age = 10.10 ± 0.66 years), at risk of overweight (n = 110, age = 10.18 ± 0.58 years), overweight (n = 59, age = 10.23 ± 0.68 years). The result of ANOVA for the four groups regarding the "age" variable showed that the value of (P) was (0.987) with significance of (0.398), which indicates a lack of significant differences for the four groups.

Table (1) shows the statistical characterization of the sample in the tests of physical abilities and fitness level under discussion.

Table (1)

Statistical characterization of the sample according to the weight status in BMI, physical abilities and fitness level

Weight status	Statistics / Variables	Mean	S.Td	Range	Min.	Max.
Underweight N=63	Body Mass Index	12.94	0.48	0.06	11.59	13.44
	Hand grip (Newton)	15.43	3.33	15.00	10.00	25.00
	30m sprint (sec.)	6.11	0.61	2.73	5.00	7.73
	Sit ups (1 min.)	40.38	8.88	30.00	30.00	60.00
	Standing long jump (cm)	117.29	17.96	61.00	85.00	146.00
	Stand and reach (cm)	2.79	2.55	7.00	0.00	7.00
	(800m) run-walk (min.)	5.58	0.28	0.82	5.23	6.05
	Zig-zag test (sec.)	8.00	1.07	4.10	5.60	9.70
	Numbered circles (sec.)	11.44	1.11	4.10	9.10	13.20
	Balance beam test (sec.)	11.58	0.28	0.82	11.23	12.05
	Fitness level	475.43	30.64	155.75	399.31	555.06
Healthy weight N=291	Body Mass Index	15.56	1.26	0.07	13.47	18.09
	Hand grip (Newton)	17.48	3.07	17.00	10.00	27.00
	30m sprint (sec.)	6.08	0.80	2.36	4.64	7.00
	Sit ups (1 min.)	44.62	10.84	38.00	30.00	68.00
	Standing long jump (cm)	122.28	15.97	81.00	90.00	171.00
	Stand and reach (cm)	1.62	1.75	6.00	0.00	6.00
	(800m) run-walk (min.)	5.39	0.50	2.32	4.48	6.80
	Zig-zag test (sec.)	8.13	1.12	4.60	5.47	10.07
	Numbered circles (sec.)	11.60	1.14	4.60	8.97	13.57
	Balance beam test (sec.)	10.39	0.50	2.32	9.48	11.80
	Fitness level	476.35	24.32	107.14	421.70	528.84
At Risk for Overweight N=110	Body Mass Index	20.24	1.49	0.14	18.09	22.81
	Hand grip (Newton)	17.48	3.15	16.00	10.00	26.00
	30m sprint (sec.)	7.01	0.79	3.75	5.11	8.86
	Sit ups (1 min.)	40.94	6.35	26.00	30.00	56.00
	Standing long jump (cm)	116.23	9.87	40.00	100.00	140.00
	Stand and reach (cm)	1.25	1.60	7.00	0.00	7.00
	(800m) run-walk (min.)	6.12	0.50	1.77	5.48	7.25
	Zig-zag test (sec.)	9.23	1.13	5.70	6.00	11.70
	Numbered circles (sec.)	12.71	1.15	5.73	9.47	15.20
	Balance beam test (sec.)	9.12	0.50	1.77	8.48	10.25
	Fitness level	418.83	20.93	116.68	372.82	489.50
Overweight N=59	Body Mass Index	25.66	2.56	0.33	22.83	32.66
	Hand grip (Newton)	17.46	4.06	15.00	10.00	25.00
	30m sprint (sec.)	7.78	0.93	3.00	6.00	9.00
	Sit ups (1 min.)	37.97	3.83	12.00	30.00	42.00
	Standing long jump (cm)	104.49	15.78	55.00	80.00	135.00
	Stand and reach (cm)	0.46	0.90	3.00	0.00	3.00
	(800m) run-walk (min.)	6.47	0.54	1.52	5.73	7.25
	Zig-zag test (sec.)	10.86	0.75	2.70	9.00	11.70
	Numbered circles (sec.)	14.32	0.86	4.00	11.20	15.20
	Balance beam test (sec.)	7.47	0.54	1.52	6.73	8.25
	Fitness level	354.52	24.27	118.35	294.22	412.57

- Statistical treatments:

Statistical Package for Social Sciences (SPss), Version (20) was used to obtain the following variables: (arithmetic mean, standard deviation, the least and the greatest values, percentiles, (t) value, Pearson correlation coefficient, one-way analysis of variance, Scheffe test for the least significant difference, squared ETA to calculate the size of effect)

Results

Table (2)

The relationship between BMI and the physical variables

Correlation (r) N = 523	Hand grip (Newton)	30m sprint (sec.)	Sit ups (1 min.)	Standing long jump (cm)	Stand and reach (cm)	(800m) run-walk (min.)	Zig-zag test (sec.)	Numbered circles (sec.)	Balance beam test (sec.)	Fitness level
BMI	0.13**	0.53**	-0.31**	-0.29**	-0.34**	0.62**	0.63**	0.63**	-0.81**	-0.82**
Sig.	0.003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****Correlation is significant at the 0.01 level (2-tailed)**
***Correlation is significant at the 0.05 level (2-tailed)**

Table (3)

The relationship between BMI and the physical variables

Statistics n=523 / Variables	Source of variation	df	Sum of Squares	Mean Square	F	Sig.	Effect Size Value	Effect Size Level
Hand grip (Newton)	Between Groups	3	233.32	77.78	7.39	0.00	0.21	Intermediate
	Within Groups	519	5460.22	10.52				
	Total	522	5693.54					
30m sprint (sec.)	Between Groups	3	185.91	61.97	98.75	0.00	0.76	Great
	Within Groups	519	325.70	0.63				
	Total	522	511.61					
Sit ups (1 min.)	Between Groups	3	3067.13	1022.38	11.99	0.00	0.26	Intermediate
	Within Groups	519	44242.00	85.25				
	Total	522	47309.13					
Standing long jump (cm)	Between Groups	3	16395.67	5465.22	23.83	0.00	0.37	Great
	Within Groups	519	119053.82	229.39				
	Total	522	135449.48					
Stand and reach (cm)	Between Groups	3	178.94	59.65	19.18	0.00	0.33	Great
	Within Groups	519	1614.25	3.11				
	Total	522	1793.20					
(800m) run-walk (min.)	Between Groups	3	83.39	27.80	117.66	0.00	0.82	Great
	Within Groups	519	122.60	0.24				
	Total	522	205.99					
Zig-zag test (sec.)	Between Groups	3	431.82	143.94	122.76	0.00	0.84	Great
	Within Groups	519	608.54	1.17				
	Total	522	1040.37					
Numbered circles (sec.)	Between Groups	3	429.90	143.30	116.51	0.00	0.82	Great
	Within Groups	519	638.36	1.23				
	Total	522	1068.26					
Balance beam test (sec.)	Between Groups	3	662.31	220.77	934.58	0.00	2.32	Great
	Within Groups	519	122.60	0.24				
	Total	522	784.91					
Fitness level	Between Groups	3	876663.61	292221.20	387.98	0.00	1.50	Great
	Within Groups	519	390907.60	753.19				
	Total	522	1267571.21					

Table (4)

Significance of differences between the different weight statuses in physical abilities using Scheffe test

Variables	Groups	Mean	Mean Differences			
			Underweight	Healthy weight	At Risk for Overweight	Overweight
Hand grip (Newton)	Underweight	15.43		-2.06*	-2.05*	-2.03*
	Healthy weight	17.48			0.01	0.03
	At Risk for Overweight	17.48				0.02
	Overweight	17.46				
30m sprint (sec.)	Underweight	6.11		0.03	-0.90*	-1.67*
	Healthy weight	6.08			-0.93*	-1.70*
	At Risk for Overweight	7.01				-0.77*
	Overweight	7.78				
Sit ups (1 min.)	Underweight	40.38		-4.24*	-0.56	2.41
	Healthy weight	44.62			3.68*	6.65*
	At Risk for Overweight	40.94				2.97
	Overweight	37.97				
Standing long jump (cm)	Underweight	117.29		-5.00	1.06	12.80*
	Healthy weight	122.28			6.06*	17.79*
	At Risk for Overweight	116.23				11.74*
	Overweight	104.49				
Stand and reach (cm)	Underweight	2.79		1.17*	1.54*	2.34*
	Healthy weight	1.62			0.37	1.16*
	At Risk for Overweight	1.25				0.80
	Overweight	0.46				
(800m) run-walk (min.)	Underweight	5.58		0.19*	-0.54*	-0.89*
	Healthy weight	5.39			-0.73*	-1.08*
	At Risk for Overweight	6.12				-0.35*
	Overweight	6.47				
Zig-zag test (sec.)	Underweight	8.00		-0.14	-1.24*	-2.87*
	Healthy weight	8.13			-1.10*	-2.73*
	At Risk for Overweight	9.23				-1.63*
	Overweight	10.86				
Numbered circles (sec.)	Underweight	11.44		-0.16	-1.27*	-2.87*
	Healthy weight	11.60			-1.11*	-2.71*
	At Risk for Overweight	12.71				-1.60*
	Overweight	14.32				
Balance beam test (sec.)	Underweight	11.58		1.19*	2.46*	4.11*
	Healthy weight	10.39			1.27*	2.92*
	At Risk for Overweight	9.12				1.65*
	Overweight	7.47				
Fitness level	Underweight	475.43		-0.92	56.60*	120.91*
	Healthy weight	476.35			57.52*	121.83*
	At Risk for Overweight	418.83				64.31*
	Overweight	354.52				

Significant at the 0.05 level for the group

Figure (1)

Arithmetic mean of the physical abilities for the weight statuses

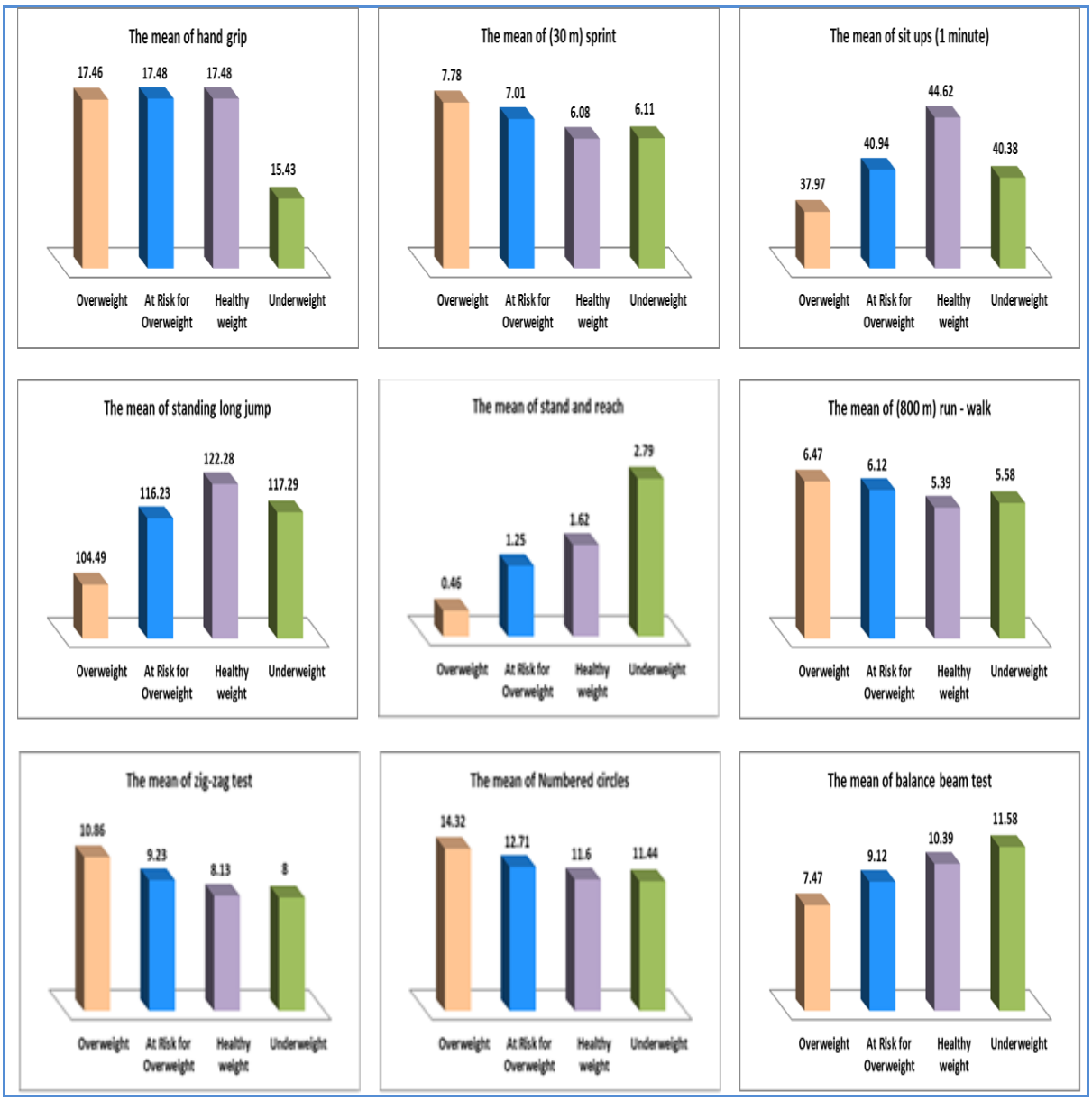
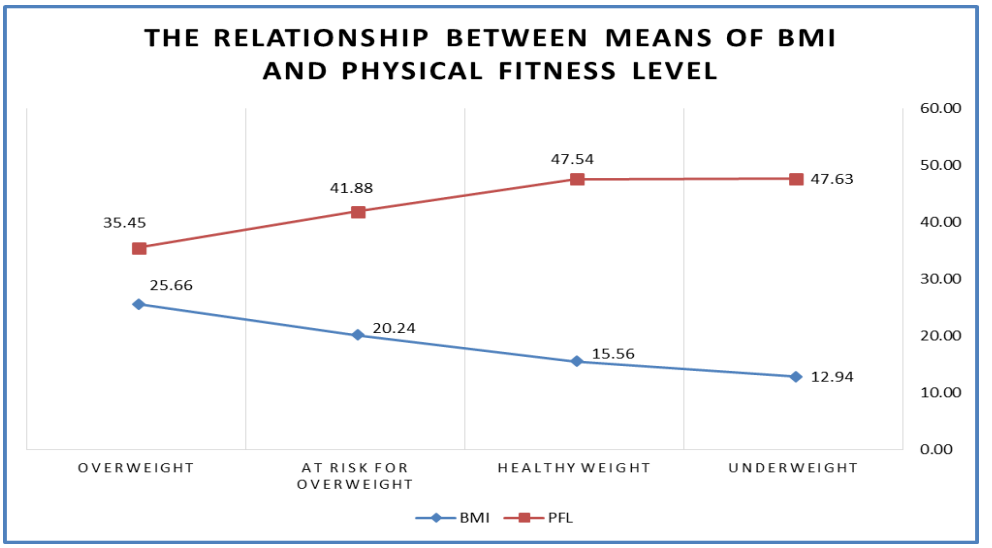


Figure (2)

The relationship between means of BMI and physical fitness level



Discussion:

This study aimed to compare between the different weight statuses in some physical abilities of the (9:12) years-old children in Al-Baha region. The physical abilities under study were determined as there was a significant correlation between them and BMI according to the results of table (2), which are consistent with the results of many other studies such as: (Zahra et al., 2015) (Seryozha et al., 2015) (Ziad, 2010) (Ortega et al., 2008) (Ortega et al., 2007) (Luna et al., 2005)

The results of tables (3) and (4) of the one-way analysis of variance between the different weight statuses in the physical abilities under study, and the significance of those differences using Scheffe test showed that there were significant differences in "the hand grip test to measure the fixed maximum strength" between the weight statuses in favor to the weight statuses with higher BMI, and this is consistent with the study of (Ziad, 2010), as the height and weight variables used in calculating the BMI do not just reflect the percentage of fat, but also reflect the amount of fat, muscles and bones together, which gave the above mentioned results of the research sample. (Ziad, 2010)

The results also showed that there are significant differences between the different weights regarding the variable of "30m sprint to measure the speed of transition" in favor to the weights with the lower BMI where the results of the previous studies indicate an inverse relationship between the transition of speed and BMI, as the transition of speed means the individual's ability to move the body mass from one place to another in the shortest possible time. This explains the result of this research where the lower weights in the BMI are faster than their peers with high BMI. (Abed and Mohammad, 2015)

The results again showed that there were significant differences in the "sit-ups (1 min.)" variable among the healthy weight statuses as the results indicate an inverse relationship between the muscular endurance of the abdominal muscles and BMI, which is consistent with the results of (Koji and Michelle 2013) that the normal weight positively affect the amount of the individual's muscular endurance. (Koji and Michael, 2013)

The results showed that there were significant differences in the "standing long jump" variable to measure the muscular ability of the legs among the weight statuses of the research in favor to the healthy weight status, where the results indicate an inverse relationship between the muscular ability and BMI; this is due to the negative effect of the increase of weight mass, which is an additional load on the ability of the leg muscles. This is consistent with the results of (Ali, 1992), who confirmed the correlation between the muscular ability of the legs with the various corporal measurements, including height and weight.

The results showed that there were significant difference in the "stand and reach" variable to measure the flexibility between the weights in favor to the underweight, where the results indicate an inverse relationship between flexibility and BMI, due to the negative impact of the increase of weight mass that negatively affects the flexibility of the body due to the increase in the mass of

fat, and this is consistent with the results of (Aboshkair et al., 2012) and (Wu et al., 2012)

The results showed that there were significant differences in the "800m run-walk" variable to measure the endurance between the weight statuses under study in favor to the lower weights, and this conforms to the study of (Ziad Zayed, 2010), which indicates that the corporal structure significantly affects the maximum consumption of oxygen, which is consistent with the results of the study of (Michand et al., 2002), that showed the correlation between physical fitness, physical measurements and maximum consumption of oxygen. (Michand et al., 2002) (Ziad, 2010)

The results showed that there were significant differences in the "zig-zag test" to measure agility between the weights under study in favor to the lower weights, as the increase of weight mass forms an additional load on the muscles and joints, and thus decreases agility. This is consistent with the study of (Bahpour and colleagues, 2002) that showed an inverse relationship between BMI and agility.

The results showed that there were significant differences in the "numbered circles" variable to measure compatibility between the different weights in favor to the lower weights, due to the negative effect of the increase of weight mass and its negative effect on the speed of feet movements and the change of direction in performing the compatibility test as well.

The results showed that there were significant differences in the variable of "balance beam test" to measure the balance between the weight statuses in favor to the lower weights, and this is consistent with the study of (Abed and Mohammad, 2015) and (Taghinejad, 2013) that showed an inverse relationship between BMI and balance, because BMI increases as the balance of the body decreases. The results of this study show significant differences between the different weights and fitness levels in favor to the lower BMI values, which indicate an inverse relationship between the BMI and the fitness level of the research sample. The results of the effect size shown in table (3) indicate that the effect size level of the physical abilities ranged from "intermediate" to "great", which confirms the extent to which physical abilities were affected by the individual's weight. The order of physical abilities according to the effect size from the greatest to the lowest based on the weight status with significance of BMI was as follows: (balance, agility, endurance, compatibility, speed, muscular ability, flexibility, muscular endurance, and maximum strength) respectively, which is consistent with the results of table (2) that shows the correlation between the value of BMI and the physical abilities, which conforms with the result of effect size level, where balance came at the first order and the maximum strength came at last regarding the correlation coefficient with BMI. Further research to explain the causality of this result is recommended by the researcher.

Conclusion:

Through the results of the study, we were able to determine the characteristics of the research sample in the research variables that included BMI and the fitness level according to the physical abilities under study. It was also easy to infer the level of general physical state of the research sample in light of identifying the weight status through the BMI, as overweight children are often characterized by low fitness rates according to the fitness level under study.

Recommendation:

In light of the research findings, the researcher recommends using the current relationships between the body mass index and the physical abilities under study in directing the students to practice the appropriate sports activities according to their physical state and their physical characteristics shown in the results of the current study; using the standards concluded in the study in evaluating the fitness level of the students of the age group under study to predict the health risks that may occur to them; planning the training process for the overweight cases who might have a high fitness level as the training can be increased to remove fat as well as taking advantage of the skilled physical abilities in the appropriate physical activities.

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