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RESEARCH ARTICLE

INVESTIGATION OF THE RELATIONSHIP BETWEEN BMI AND IQ SCORE IN FEMALE AGE 16-18 YEARS IN ALHASSA.

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Abstract

Background:- Several studies are investigated the relation between BMI and intelligence level. Some of them found that childhood full IQ (FIQ) was inversely associated with obesity in pre-school children. (7) In other studies, Intelligence quotient (IQ) was measured in childhood and adulthood. They found lower IQ scores for childhood-onset obesity. (8) In addition, some studies resulted that the non-obese control group had higher intelligence test score and educational level than obese person. There for this study aims to investigate the relationship between BMI and IQ in Al-hasa.

Objective:- To investigate whether there is relationship between BMI and IQ among 16 to 18 years old females .

Research Methods and Procedures:- Data were selected from 16 to 18 years old females in 3 high schools in Al-Hassa. Study sample consisted of 60 to 80 females, 20 selected randomly from each school included in the research. Each school population divided into strata according to the age group, also weight, scale, meter and self-administered standardized IQ were used for collecting the data. Then their score were calculated by administering IQ test and compared with BMI to assess their performance by using chi-square test.

Results:- There is no significant relationship between IQ and BMI, so there is no difference if the student is ideal in weight, obese or underweight to get high scores in IQ. In addition, number of obese students have high IQ scores.

Conclusion:- This study shown that the BMI of the sample which were included in the research not affect the IQ results . But there might be another factors which affect IQ other than BMI .

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Chapter 1:-

Introduction:-

Human brain is a great machine that needs 25% of oxygen, sugar and calories consumed by the body; it became clear that the process of thinking require most of them (1). Your brain cells need two times more energy than the other cells in your body. Neurons, the cells that communicate with each other, have a high demand for energy because they're always in a state of metabolic activity. Even during sleep, neurons are still at work repairing and rebuilding their own out structural components (2). As known, energy comes from glucose sugar thus from food.

Food and other factors like heredity, diseases, medication and etc. All these can affect the body weight thus affect the body mass index (BMI) (3), or Quetelet index, is a measure for human body shape based on an individual's mass and height. It is defined as the individual's body mass divided by the square of their height - with the value universally being given in unit of kg/m^2 .

Intelligence (4) is an abstract concept which definition continually evolves and often depends upon current social values as much as scientific ideas. Modern definitions refer to a variety of mental capabilities, including the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience as well as the potential to do so. (5) Intelligence test is a standardized procedure of mental assessment to determine an individual's intellectual ability. The result is produced as a score termed the Intelligence Quotient (IQ)

Several studies are investigated the relation between BMI and intelligence level:-

(6)Yu, Z. B., et al. (2010), china. Done a study in a hospital and found that childhood full IQ(FIQ) was inversely associated with obesity in pre-school children.(7) Also, BelskyDW, et al. (2013), based on data from the ongoing cohort study in New Zealand. Intelligence quotient (IQ) was measured in childhood and adulthood. They found lower IQ scores for childhood-onset obesity. (8)In addition, Halkjær, J, et al. (2003), In Copenhagen University Hospital, Denmark. Resulted that the non-obese control group had higher intelligence test score and educational level than obese person. So, it is important to know if these relationships present or not.

Aim:-

The aim of this research to find out whether there is Relationship between BMI and IQ Score in Female Age 16-18 years in Al-Hassa.

Objectives:-

- ❖ To measure the height and weight of participant .
- ❖ To calculate their BMI.
- ❖ To assess their IQ scores.
- ❖ To find out the relationship between BMI and IQ scores.

Chapter 2:-

Literature review:-

There are multiple factors which affect the IQ or BMI (the variables of this study) ,so this literature view present some of these factors according to some previous studies . These factors are Physical activity , duration of breast feeding and socioeconomic status .

Mortality rate and overweight:-

Scott W. Keith and others did study to find actual affect of overweight-obesity on the lifespan or mortality which have great value for helping to establish valid clinical and public health recommendations around weight loss and mortality. Scott W. Keith and others did that in 2013 March 25 by suggested modeling BMI as a continuous variable, switching to modeling longevity instead of mortality, and generating large publicly available datasets in broad and diverse populations for discerning the extent to which the BMI–mortality relationship differs between groups and over time. They found that normal weight, grade 1 obesity was not associated with elevated mortality and overweight was associated with significantly lower mortality (9) . But Lisa M. Pollack and other did study that contradict with Keith's study .They found that obesity-attributable co morbidities are associated with large decreases in life span and increases in mortality rates. They did that by using data from the National Health Interview Survey, in 1997-2000. That they employed mixed proportional hazard models to estimate the association between those ORDs (obesity-related diseases) and mortality and used simulations to project life years lost associated with the ORDs(10) .

Association between duration of breast feeding and adult intelligence:-

In the research article by Erik , et al (2002) ,there is one question was addressed for guiding the study . Is the duration of infant breastfeeding will affect on the intelligence of young adulthood ?The focus of investigation was on young adulthood, an age when cognitive functioning is optimal and intelligence test scores are highly stable. It is hypothesized that there is a positive association between breastfeeding and cognitive and intellectual development in early and middle childhood so will affect on the adult intelligence. It used Prospective longitudinal birth cohort study .the sample consisted of 973 men and women and a sample of 2280 men were divided into 5 categories based

on duration of breastfeeding. the Intelligence was measured by using the Wechsler Adult Intelligence Scale (WAIS) at a mean age of 27.2 years in the mixed-sex sample and the BørgePriensPrøve (BPP) test at a mean age of 18.7 years in the all-male sample. The result in this study supported the hypothesis where the duration of breastfeeding was associated with significantly higher scores on the Verbal, Performance, and Full Scale was observed in 2 independent samples of young adults, assessed with 2 different intelligence tests (11).

Socioeconomic status and children's intelligence:-

In February 1, 2012 Ken B. Hanscombe and others published an article about the Socioeconomic Status (SES) and Children's Intelligence, they used 8716 twin pairs from the Twins Early Development Study (TEDS), they attempted to replicate the reported moderating effect of SES on children's intelligence at ages 2, 3, 4, 7, 9, 10, 12 and 14 at every age they measured general cognitive ability with one verbal and one non-verbal tests and also measured Parental education and occupation at age 7 and Parental income at age 9. They found greater variance in intelligence in low-SES families is due to moderation of the environmental effect – an environment-environment interaction (12).

Physical activity and intelligence:-

Frances O'Callaghan and others did study in 2012 about the relationship between physical activity and IQ. They collected their data from the Mater–University of Queensland Study of Pregnancy then they measured IQ at the 14-year follow-up and IQ and PA at 21 years. Mean IQ scores are presented at the 21-year follow-up adjusted for IQ at 14 years, and PA and other variables. They found less vigorous exercise were associated with higher IQ, but neither higher levels of vigorous exercise nor walking were associated with IQ (13).

Intelligence Test Score and Educational Level in Relation to BMI Changes and Obesity:-

Halkjaer J, Holst C, Sørensen TI estimated whether intelligence and education are related to subsequent changes in weight and risk of development and persistence of obesity in man. They did study by that The data were selected among men appearing at Danish draft boards from the period of 1956 to 1977, The study sample consisted of two groups: a group with juvenile-onset obesity and a nonobese control group. The group with juvenile-onset obesity including all men with a BMI of ≥ 31.0 kg/m²; and a no obese group randomly selected as a 1% sample of the study population. The obese group and 50% of the non obese group were invited to participate in follow-up studies. Two follow-up surveys were conducted, one between 1982 and 1984 and another between 1992 and 1994. Participants in the first follow-up survey included 907 (58%) of the 1564 individuals with juvenile-onset obesity at baseline and 883 (74%) of the 1191 non obese controls. At the second follow-up, 747 individuals with juvenile-onset obesity (49% compared with baseline) and 730 no obese controls (61% compared with baseline) participated. For intelligence testing, (BPP-53) test was applied. Variables at baseline and first and second follow-up for the no obese control and the obese groups were age, intelligence test score, education, and BMI were analyzed in multiple linear and logistic regression models. They found that When they investigated whether intelligence test score and educational level separately, both intelligence test score and educational level had an inverse effect on the subsequent BMI changes and risk of developing obesity. But when investigated simultaneously, the effects of intelligence test score were more reduced than those of education. At the end, the intelligence test score in young men was inversely related to subsequent changes in BMI, perhaps with educational level acting as a mediator or indicator of the cognitive ability. Similar, but less consistent, relationships were found for the development of obesity. Persistence of obesity among men with obesity was strongly inversely related to educational level, but not to the intelligence test score(14).

Chapter 3:-

Methodology:-

The study intends to find the relation between the BMI and IQ among 16 to 18 years old females from Al Hassa in order to reach the objective of the research. Our research method is cross sectional that provide collection of data within a specific time among a particular area, we investigated that by visiting different female high schools in some villages of Al Hassa that contain the required age groups, so by that it became more easier for us to find the proper sample within a short time.

Study design:- Descriptive cross sectional study.

It is a research method often used in developmental psychology, but also utilized in many other areas including social science and education. This type of study utilizes different groups of people who differ in the variable of

interest, but share other characteristics such as socioeconomic status, educational background, and ethnicity. (1)

The place:-

3 high schools from different villages in Al-Hassa

The sample:- (Stratified random sample)

About 67 females at 16 – 18 age group

22 to 23 individuals was drawn at random from each school included in the research. Each school's population was divided into strata according to the age group . The size of the data was determined by the sampling fraction .

instruments:-

weight scale , meter and standard progressive matrices IQ test (2).

Work plan:-

The results of previous researches that have a relation with our research was collected.

The procedure was started by taking an approval letter from the university , then the different schools that have been chosen to take their agreement was visited.

The student advisor was asked to find the sample from each class

Their permission was taken to answer the questions and to take their body weight and height .

The information that we collected from the sample was age , weight and height .

The intelligence quotient was assessed by standard progressive matrices test in 45 min. (2)

Sample test results was marked manually .

Statistical analysis:-

In the research the mean ,mode ,median and central tendency was calculated for both IQ and BMI. The correlation between IQ and BMI was calculated .Following , the chi-square was used to investigate if there is a significant relationship

The centile of the IQ scores was evolved from table 1 according to age . It used to assess the grade of intelligent as shown in table 2 .

Table 1:-Centiles of IQ scores.

Ages			Centile
18 year	17 year	16 year	
IQ score according to age			
14	12	12	8
18	17	16	10
32	28	28	25
40	39	39	50
46	46	46	75
50	49	49	90
52	52	52	95

This table shows the Centiles of the IQ scores according to age .

Table 2:-intelligence grades.

Centile	Intelligence grade
≥ 95	Superior
94 – 75	Above average
74 – 26	Average
25 - 11	Under average
10 -6	Dullard or Borderline
≤ 5	Mental retarded

This table displays the grades of intelligence according to the centile range .

Ethical consideration :

the approval letter was taken from the university , the agreement from the school and vocal permission from the sample , the standard progressive matrices test (2)and sample’s information was saved .

Gantt chart :-

	Week 1	Week 2	Week 3	Week 4	Wee 5
Proposal writing	*****				
introduction and methodology Writing		*****			
Data collection			*****		
Data analysis				*****	
Writing report					*****

Chapter (4):-

Results:-

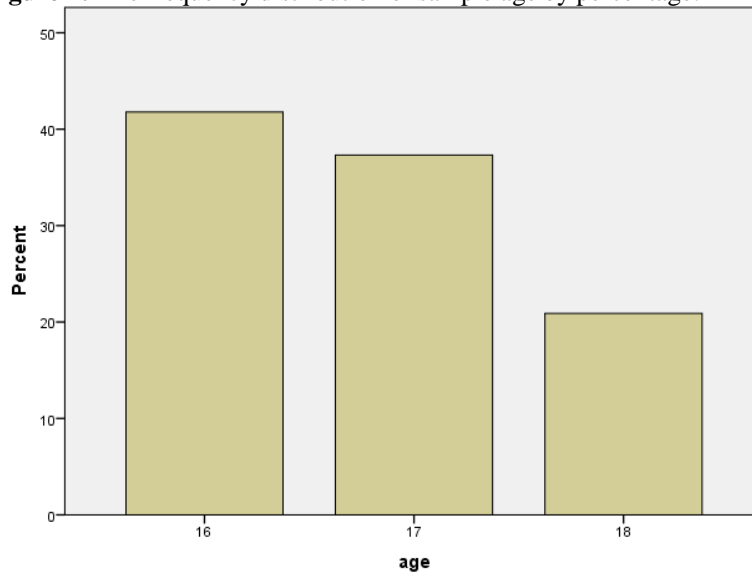
This study have been conducted on Al-Hassa female students in order to take a position in the controversy about the relation between BMI and IQ .The descriptive data analysis of this study showed this results by using SPSS program.

Table3:-Descriptive Statistics of BMI and IQ .

Descriptive Statistics		intelligent	Body mass index
N	Valid	67	67
	Missing	0	0
Mean		42.1791	27.5822
Median		43.0000	27.0000
Mode		45.00	20.00
Std. Deviation		8.30649	9.24133
Range		49.00	45.24
Minimum		9.00	15.80
Maximum		58.00	61.04
Sum		2826.00	1848.01

This table displays that by calculating the mean of BMI and IQ scores for the research sample (N=67) , the analysis shows that average BMI of the students was M= 27.58 + SD= 9.24 .The most frequently BMI was 20 . While there IQ average was M= 42.18 + SD 8.31and the most frequently score was 45 .

Figure 1:-The frequency distribution of sample age by percentage.



The figure showed that near 80 % of the sample range in ages between 16-17 and about 20% of the sample was 18 year old .

Table 4:-The frequency distribution of sample IQ scores

Grade	Frequency	Percent	Cumulative Percent
average	44	65.7	65.7
more than average	17	25.4	91.0
excellent	3	4.5	95.5
mental retarded	2	3.0	98.5
less than average	1	1.5	100.0
Total	67	100.0	

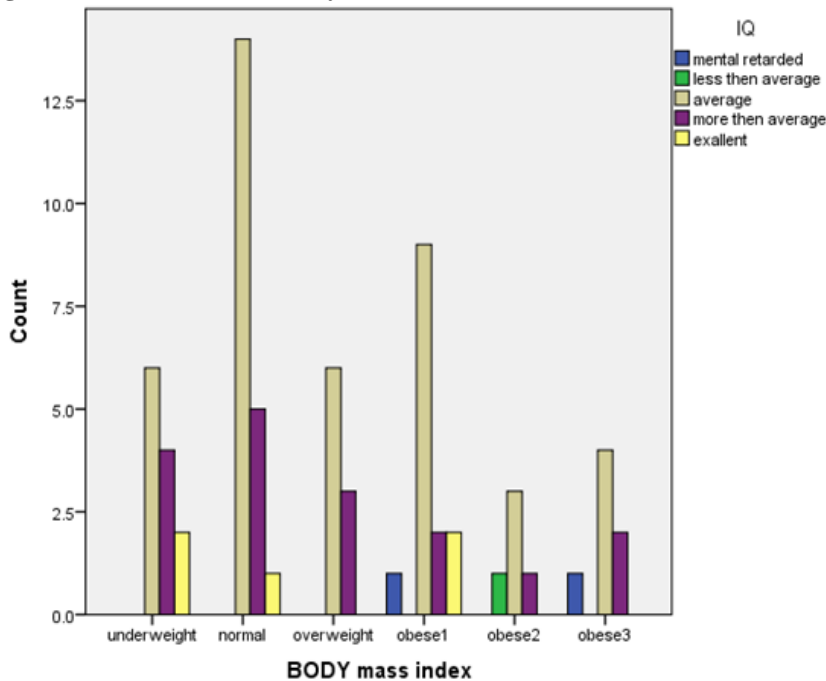
It is obvious from The table above that more than half of the students have an average intelligent ,while one quarter had more than average intelligent .

Table 5 :-body mass index * IQ Cross tabulation.

BODY mass index		IQ					Total
		mental retarded	less than average	average	more than average	excellent	
	Under weight	0	0	6	4	2	12
	normal	0	0	14	5	1	20
	overweight	0	0	6	3	0	9
	obese1	1	0	9	2	2	14
	obese2	0	1	3	1	0	5
	obese3	1	0	4	2	0	7
Total		2	1	42	17	5	67

This table displays the relation between the BMI of the students and their IQ scores . It shown that the majority of the sample including all types of BMI, have an IQ scores between average and little pit more than average .

Figure 2: body mass index * IQ bar chart



The same relationship displayed on table 3 is plotted here as bar chart figure .

To conclude the results, chi-square test was used for testing the correlation significance. The test result was -person chi-square -0.271 and the P-value was $.999$ which indicates that there is no significant relationship between the BMI and IQ scores.

Chapter 5:-

Discussion:-

This study's hypothesis is there is a relationship between BMI and IQ in female in Al-Hassa. The result of this study showed that there is no significant relationship between the BMI and IQ in 16-18 old female in Al-Hassa. Obese and underweight females in this study showed IQ equal or even more than those with normal weight. That supports the result of previous study (5,5) which showed that obesity among obese men was strongly inversely related to educational level, but not to the intelligence test score. Also that interferes with other study which showed non-obese control group had higher intelligence test score and educational level than obese person (8). Though it is a small study however, it can assure that there is no difference in IQ score between obese females in Alhasa and normal weight females. But there are other factors which affect IQ other than BMI which is not included in this research like duration of breast feeding which is discussed in chapter 2 that duration of breastfeeding was associated with significantly higher IQ score (2,2), socioeconomic status there is a study found a great variance in intelligence in low socioeconomic status families (2,3) and physical activity which is mentioned in literature review chapter 2 that less vigorous exercises is associated with higher IQ score (4,2). That factor may have influence on the result of this study, but it is beyond the scope of study.

Chapter 6:-

Conclusion:-

The hypothesis of this study explains that there is an inverse relation between BMI and IQ. After using descriptive cross sectional study among 16-18 Saudi female students in three high schools. The result of the study showed that there is no significant relation between BMI and IQ, which means that being obese does not mean to have less IQ result. The previous studies showed different results, one study found that there is an inverse relation between BMI and IQ in pre-school child. Another study found that the non-obese people have higher IQ scores. The results of this study might be affected by other factors which were discussed in other studies, such as: physical activity which is mentioned in literature review chapter 2 that less vigorous exercises is associated with higher IQ score (4,2), duration of breastfeeding which is discussed in chapter 2 that duration of breastfeeding was associated with significantly higher IQ score (2,2), and socioeconomic status there is a study found a great variance in intelligence in low socioeconomic status families (2,3)

Limitation:-

- The sample size is small, beside thirteen test was administered and had not completed.
- Data collection-BMI and IQ – took about one hour.
It considered to be a lengthy time by participants.

Recommendations:-

Future recommendations for researcher who want to investigate this relationship:

- To use more than IQ test
- To measure the different aspect of intelligence such as verbal, - practical and etc.
- To consider the effect of other factors such as : socioeconomic status, the duration of breastfeeding and good nutrition .
- Large sample will give more accurate results .

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