

**The association of Intelligence quotient and Self-concept with oral health status in children**

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**Citation of this Article:** Dr Nayana K M , Dr Jyothsna V Setty, Dr Ila Srinivasan, Dr Sreeraksha Radhakrishna, Dr Akhil P , Dr Clarissa Suting, “The association of Intelligence quotient and Self-concept with oral health status in children”, IJDSIR- February - 2020, Vol. – 3, Issue -1, P. No. 06 – 16.

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**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

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**Introduction**

Intelligence is the property of mind, that encompasses many related abilities like capacity to reason, plan, solve the problem, think, comprehend ideas, use languages and learn.<sup>1</sup> Intelligence quotient (IQ)<sup>1</sup> is a score derived from a set of standardized tests developed to measure a person's cognitive abilities in relation to their age group.

Wechsler defined intelligence as “an individual’s ability to adapt and constructively solve problems in the environment.”<sup>3</sup> Whereas, IQ is defined as the “Relative

intelligence of an individual expressed as a score on a standardized test of intelligence.”<sup>4</sup> Intellectual level of a person influence the abilities to learn from experience, adapt to new situations, understand and handle abstract concepts, and use knowledge to manipulate one’s environment.

In a country like India, the children are undergoing a multitude of experiences, and various influences are affecting them. A proper psychological testing can only

enable any sincere and effective steps in the development of any plans and strategies for children. Moreover, it is also important to know how young people with dental caries and gingivitis feel about themselves, which is integral to the development of a positive child-clinician relationship.

Self-concept<sup>2</sup> appears to be a comprehensive area which can represent the personality at large. It develops as a result of interaction of the individual with the society. It is the mental image of a person as to what he is and what he thinks he is to other people. Murphy (1947) described self-concept as “The individual known to the individual”. Cattell (1957) referred to self-concept as the “key stone personality”. Self-concept influences quality of person’s behaviour and his method of adjustment to life and situation. Lewin (1951) has pointed out that it gives “consistency to personality”

The most widespread misconception that a mere intelligence quotient(IQ) score of above 150 can open doors for success and prosperity is what deters adults from introducing their children and students to the fascinating field of emotional intelligence. As put forth by Goleman, IQ determines only 20% of success that individuals achieve in their lives, while 80% of it is determined by one’s emotional quotient. We, as professionals, should assume the unequivocal responsibility of communicating these and other similar findings to the general population in as many ways as possible.

Children who can better cope with frustrations and challenges are more likely to think of themselves as successful which will lead to a higher self-esteem. In contrast, children who become easily frustrated and discouraged, often quit or need extra assistance to complete a task. These children may have lower self-esteem if they start to believe that they can't be successful.

Self-esteem serves a motivational function by making it more or less likely that people will take care of themselves and explore their full potential. People with high self-esteem are also people who are motivated to take care of themselves and to persistently strive towards the fulfilment of goals. People with lower self-esteem tend to let important things slide and to be less persistent. They are generally less motivated to pursue them to their conclusion.

Nowadays concept of oral health involves the interaction between genetic and environmental factors in which biological, social, behavioural and psychological components are expressed in a highly complex and interactive manner. To find out if there is any association between intelligence quotient and self-concept which are two major psychological parameters designing character of children during their preadolescent ages with oral health status, the present study is conducted selecting children with similar socioeconomic background.

Any significant association will help in providing better ways of oral health care management in these children.

### **Materials and Methods**

This cross sectional, observational study was conducted by the Department of Paediatric and Preventive Dentistry, M.R Ambedkar Dental College and Hospital. After obtaining approval from the Institutional Review Board and Ethics Committee the study was conducted through school dental health camps of schools in Bangalore city along with permission and consent from Head of the institution and written informed consent from parent and assent from child.

Based on published literature<sup>3</sup>, assuming 90% power, 5% level of significance, 5% absolute precision, the required sample size was 87. In our study we have included a sample of 200 subjects - including both males and females

in equal distribution, aged 8-12 years from the schools in East Bangalore city, Karnataka.

#### **Inclusion criteria**

- Children 8-12 years of age.
- Children belonging to middle socioeconomic class on the basis of Revised Modified BG Prasad socioeconomic classification scale, 2016

#### **Exclusion criteria**

- Children with local factors that can affect gingival health, like lip incompetence, mouth breathing, orthodontic appliances, cleft lip/palate.
- Children with visual, hearing or speech impairment, with systemic diseases and developmental disorders.

Cattell's culture fair intelligence test was used to measure intelligence<sup>1</sup>. A total of 4 tests categories are there in Culture fair test. Test 1 includes 12 questions, test 2 has 14 questions, test 3 included 12 questions, test 4 has 8 questions.<sup>1</sup> Dr S P Ahluwalia's Children's self-concept scale was used to determine the self-concept level.<sup>2</sup> It has a total of 6 parameters with 80 questions: parameter 1-16 questions, parameter 2-18 questions, parameter 3-12 questions, parameter 4-12 questions, parameter 5-12 questions and parameter 6-10 questions. OHI-S index, DMF index and dft index, Modified Gingival index were used measure oral health status.

#### **Results**

**Statistical Analysis:** Statistical Package for Social Sciences [SPSS] for Windows, Version 22.0. Released 2013. Armonk, NY: IBM Corp., was used to perform statistical analyses.

**Descriptive Statistics:** Descriptive analysis of all the explanatory and outcome parameters was done using frequency and proportions for categorical variables, whereas in Mean & SD for continuous variables.

**Inferential Statistics:** Chi Square Test was used to perform Age and Gender wise comparison of Intelligent Quotient and Self Concept and also the association between the IQ and self concept status among study subjects. Kruskal Wallis Test followed by Mann Whitney U test was used to perform Agewise comparison of oral health findings based on IQ Status & Self concept.

Mann Whitney Test was used to compare the mean values of oral health findings between genders. The level of significance [P-Value] was set at  $P < 0.05$

Age wise comparison of IQ had not given any consistent association between IQ and age of study subjects. The comparison gave p value of 0.13 which was not statistically significant. The comparison between age and self concept was statistically significant with (p value 0.02) indicating, as age increases self concept value also increases. (Table 1)

In gender wise comparison of IQ the p value was found to be 0.78 and self concept gave a P value of 0.42. Both comparisons were not statistically significant. (Table 2)

In comparative evaluation of IQ and self concept it was found out that ;among the study subjects with high self concept, about 60% exhibited higher values of IQ levels which is statistically significant. (Table 3) While among those with average self concept ;65.2% of the students have low values of IQ also ; distributed into below average, low and very low IQ levels. (Table 3) This comparison gives P value 0.001 and was found to be statistically significant.

The study subjects with superior, high average and above average IQ were found to have good OHI-S values, low DMFT as well as dft scores and reduced gingival index values. Those with low and very low IQ values were found to have poor oral hygiene status, increased DMFT and dft scores and higher GI values. The gradual reduction in IQ values associated with decline in Oral Hygiene status

which statistically significant with p value of  $<0.001$  (Graph :1). The rise in DMFT and dft scores with reduction in IQ value was statistically significant p value  $<0.001$ . (Graph:2 and Graph:3) The comparison between IQ and gingival health gave p value  $<0.001$  which was statistically significant. (Graph : 4)

Comparison of OHIS scores among the three groups had given statistically significant p value of  $<0.001$ ; as self concept increases OHIS scores were found to be decreasing (Table 4). Mean DMFT and dft scores among children with high self concept status is found to be less than that of above average and average self concept children. Comparison of DMFT scores was found to be statistically significant with p value  $<0.001$ . Similarly comparison of dft scores had given statistically significant p value of 0.003 (TABLE : 4 ). High self concept status' children have mean Gingival index score less than that of other two groups. This comparison was also statistically significant with P value  $<0.001$  (TABLE 4)

### Discussion

The link between low IQ and childhood psychopathology has been registered in many studies and also evaluated in children because of their behavioural problems in schools. IQ tests do not measure how emotions may interfere with a child's capabilities in school and society. A child experiencing anxiety may be quite intelligent but may perform poorly in some test simply due to emotional interferences.

The ability to adapt to a complex environment requires skills and traits that lie outside definitions of traditional intelligence. Hence in our study we have assessed IQ, as complex cognitive ability that allows humans to flexibly adapt their thinking to new problems or situations. The concept has been defined by Cattell (1971) as: "an expression of the level of complexity of relationships which an individual can perceive and act upon when he

does not have recourse to answers to such complex issues already sorted in memory".

In other words, Cattell's culture fair test measures the ability to reason under novel conditions and stands in contrast to performance based on learned knowledge and skills (Haavisto & Lehto, 2005;<sup>[5]</sup> Horn & Cattell, 1967). In our study IQ was assessed by tasks that were nonverbal and relatively culture-free.

Culture fair test measures innate intelligence that can be related to all kinds of problem solving learning potentials. According to Cattell (1971), it is related to how well an individual perceives complex relations, forms concepts and engages in abstract reasoning which is the very same concept formation capacity that an individual applies to novel problems (Jensen, 1998)<sup>[6]</sup>. It is also used in developing new abilities and in the acquisition of new knowledge which is otherwise - learning capacity. In 2005, a study by Swanson and Howard found a correlation between this innate reasoning IQ and learning capacity.

As far as mixed dentition period is taken in account, child has to get adapted to the new situations in the oral cavity like exfoliation of primary teeth and eruption of permanent teeth which usually causes pain and ulceration associated with exfoliation, eruption gingivitis associated with eruption etc.

Transitional period from childhood to adolescence, which coincides with mixed dentition stage; is an important developmental stage for physical development, formation and maturation of psychological characteristics, including self-identity and self-esteem, which may impact on adult life (Dishman et al., 2006)<sup>[7]</sup>

Thus in our study we have tried to find out association between IQ (in a way devoid of sociocultural, environmental and specific learning influences) and self concept to oral hygiene status in 8-12 year old children.

No other studies have examined IQ in the form of abstract reasoning capacity to get adapted to a novel situation as measured by Cattell's test IQ in predicting oral hygiene maintenance in children. Only one study have simultaneously examined the effect of IQ and self esteem on dental caries. (Virk et al.2012)<sup>[8]</sup>

Only very few studies have examined the association of IQ with oral health status of otherwise healthy children. Most of the studies have compared IQ and health status of either socially handicapped or mentally challenged children.

In the present study IQ, self concept and oral hygiene status was assessed in children aged 8-12 years, as this is the transitional stage of dentition and most of the children would start performing oral hygiene maintenance tasks by themselves by seven to eight years<sup>[8]</sup>. Also we aimed at an age group of children who can interpret and cooperate more effectively for IQ and self concept tests.

Self-concept develops, around age 7 or 8, when children are developmentally prepared to interpret their own feelings and abilities, and also based on feedback they receive from parents, teachers, and peers.

In the present study children of similar socioeconomic background (middle class on the basis of revised modified B G Prasad's socioeconomic scale 2016) were considered to avoid differences that could have arised due to easy availability of better oral health care services for children of higher economic background; and similarly low socioeconomic class children were not included in order to avoid interference of oral health issues due to poor availability of oral health care provisions.

Comparison between IQ and self-concept shows significant association between two parameters with p value of <0.001. High IQ children feel competent on different ability domains due to childrens' achievement levels at school, and these high-performing children would

describe their self concept upwards and low-performing children adjust them downwards. Likewise, some children may improve in their academic performance because they rate their self-concept attributes highly; and others may worsen their academic performance because they had no confidence in their abilities and as a result will fall in low self concept category. This study result is in accordance with the findings of Tomas Chamorro et al (2010)<sup>[9]</sup> in a large sample of UK twins. A study by Svetlana Pyankova et al (2016)<sup>[10]</sup> also indicated the presence of direct influences between self-concept and intelligence.

Comparison of IQ with oral health status has shown direct influence of IQ on oral health of children. It is understood from the study results that as IQ values are high, oral health status is also improving with reduced OHIS scores, DMFT values and GI scores. Similar association between IQ and dental caries is highlighted in one study by Virk P et al (2012).

The present study results are in accordance with a study done by Saumya Navit et al (2014)<sup>[11]</sup> on interrelationship of Intelligence Quotient with Caries and Gingivitis.

Another study by Wael Sabbah et al (2010)<sup>[12]</sup> in a national sample of USA adults found significant association between cognitive ability and dental status and related behaviours.

The present study also gives distinct association between selfconcept and oral health status. Those study subjects with high selfconcept levels are found to have improved oral health status.

This result is similar to that obtained by Diah Ayu Maharani et al (2019)<sup>[13]</sup>. Our results are in accordance with one study done by Junghyun Park et al (2016) to assess relationship between self-esteem and overall health behaviors in Korean adolescents.

The present study is the first study to measure IQ in the form of ability to reason under novel conditions in a way

devoid of influence of verbal memory, fluency, educational level and to compare it with oral health status of mixed dentition group of children. No other study has compared IQ and self concept levels of children belonging to this particular age group and evaluated the association of these parameters with oral health status. All the three comparisons gave statistically significant results.

Thus this method of measuring IQ and self concept is a promising endeavour to identify children more prone to oral health related issues and help to adapt early and prompt monitoring of oral hygiene practices and treatment needs with better understanding of psychological level of child's development.

### Conclusion

From the present study it can be stated that the psychological parameters like IQ and self concept can be used as oral health status indicators in young children. Combination of IQ and self concept analysis gives a puissant way of predicting oral health maintenance capacities of children. Thus assessment of the psychological parameters – IQ and self concept gives an early insight into the child's nature as well as treatment requirements.

### Acknowledgement

I am especially indebted to my colleagues Dr. K.Manasa Hegde and Dr Swathi Kakkathkar for the stimulating discussions, selfless support, insightful comments and assistance throughout my reserach. I am also thankful to Dr Santhosh Kumar, Reader, Dpt of Public Health Dentistry, R R D C H, Bangalore, who worked actively to provide me with the much needed statistical evaluation.

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**Legends Tables and Graph**

Table 1:Agewise comparison of Intelligent Quotient and Self Concept among study subjects using Chi Square Test												
Variables	Category	8 years		9 years		10 years		11 years		12 years		P-Value
		n	%	n	%	n	%	n	%	n	%	
IQ	Superior	0	0.0%	2	4.2%	1	1.4%	0	0.0%	0	0.0%	0.13
	High Avg.	0	0.0%	2	4.2%	1	1.4%	0	0.0%	0	0.0%	
	Above Avg.	0	0.0%	4	8.3%	4	5.6%	8	25.0%	0	0.0%	
	Average	4	16.7%	8	16.7%	17	23.9%	5	15.6%	4	16.0%	
	Low Avg.	11	45.8%	18	37.5%	21	29.6%	7	21.9%	7	28.0%	
	Below Avg.	8	33.3%	10	20.8%	20	28.2%	7	21.9%	11	44.0%	
	Low	1	4.2%	2	4.2%	4	5.6%	4	12.5%	3	12.0%	
Very Low	0	0.0%	2	4.2%	3	4.2%	1	3.1%	0	0.0%		
Self Concept	High	3	12.5%	19	39.6%	19	26.8%	8	25.0%	2	8.0%	0.02*
	Above Avg.	17	70.8%	21	43.8%	38	53.5%	15	46.9%	12	48.0%	
	Average	4	16.7%	8	16.7%	14	19.7%	9	28.1%	11	44.0%	

Table 2 : Genderwise comparison of Intelligent Quotient and Self Concept among study subjects using Chi Square Test						
Variables	Category	Males		Females		P-Value
		n	%	n	%	
IQ	Superior	2	1.9%	1	1.1%	0.78
	High Avg.	2	1.9%	1	1.1%	
	Above Avg.	9	8.5%	7	7.4%	
	Average	16	15.1%	22	23.4%	
	Low Avg.	36	34.0%	28	29.8%	
	Below Avg.	28	26.4%	28	29.8%	
	Low	9	8.5%	5	5.3%	
Very Low	4	3.8%	2	2.1%		
Self Concept	High	31	29.2%	20	21.3%	0.42
	Above Avg.	51	48.1%	52	55.3%	
	Average	24	22.6%	22	23.4%	

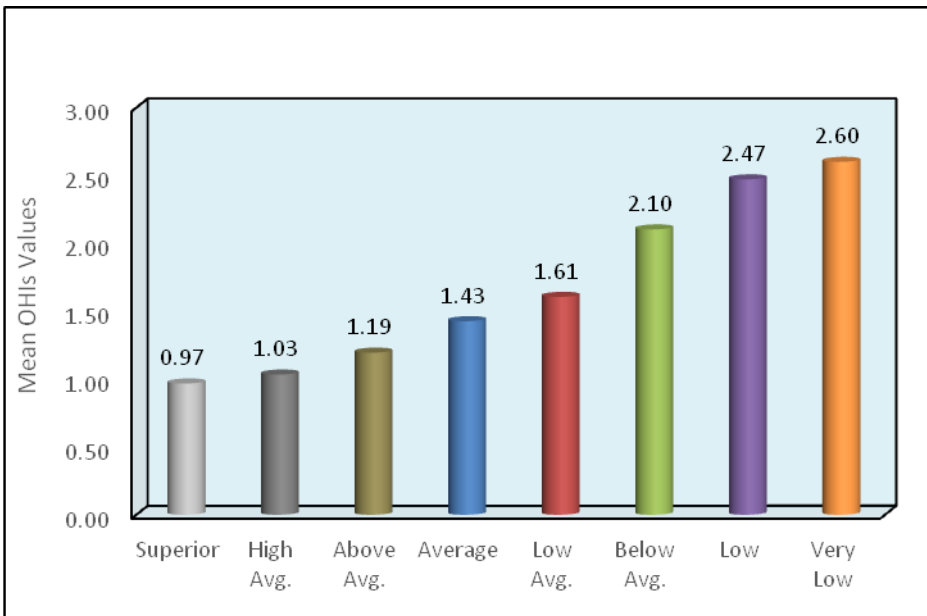


Table 3 :Comparison of association between IQ and Self Concept status among study subjects using Chi Square Test

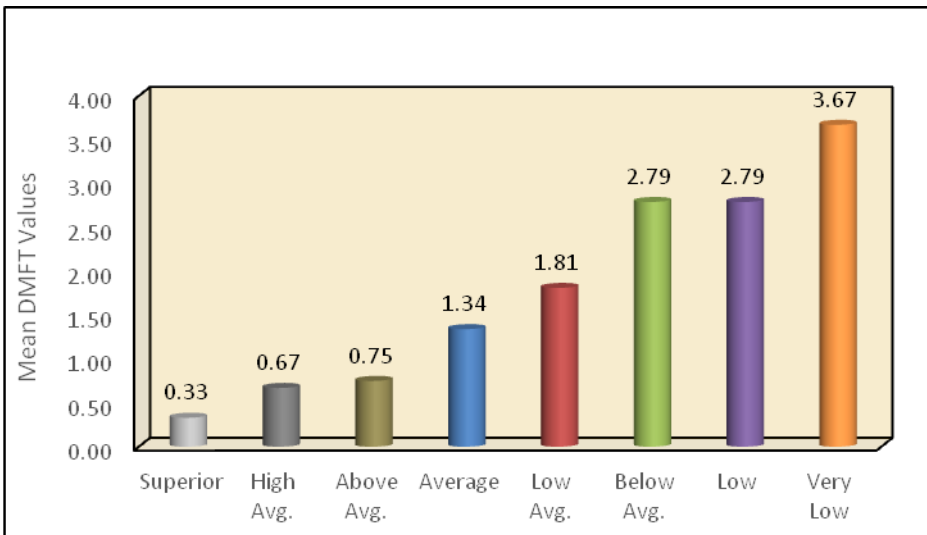
Variable	Category	High		Above Avg.		Average		P-Value
		n	%	n	%	n	%	
IQ Status	Superior	3	5.9%	0	0.0%	0	0.0%	<0.001*
	High Avg.	3	5.9%	0	0.0%	0	0.0%	
	Above Avg.	8	15.7%	8	7.8%	0	0.0%	
	Average	20	39.2%	13	12.6%	5	10.9%	
	Low Avg.	14	27.5%	39	37.9%	11	23.9%	
	Below Avg.	2	3.9%	34	33.0%	20	43.5%	
	Low	1	2.0%	9	8.7%	4	8.7%	
Very Low	0	0.0%	0	0.0%	6	13.0%		

Table 4 :Comparison of mean values of Oral health findings based on Self Concepts among study subjects using Kruskal Wallis Test followed by Mann Whitney Post hoc Test

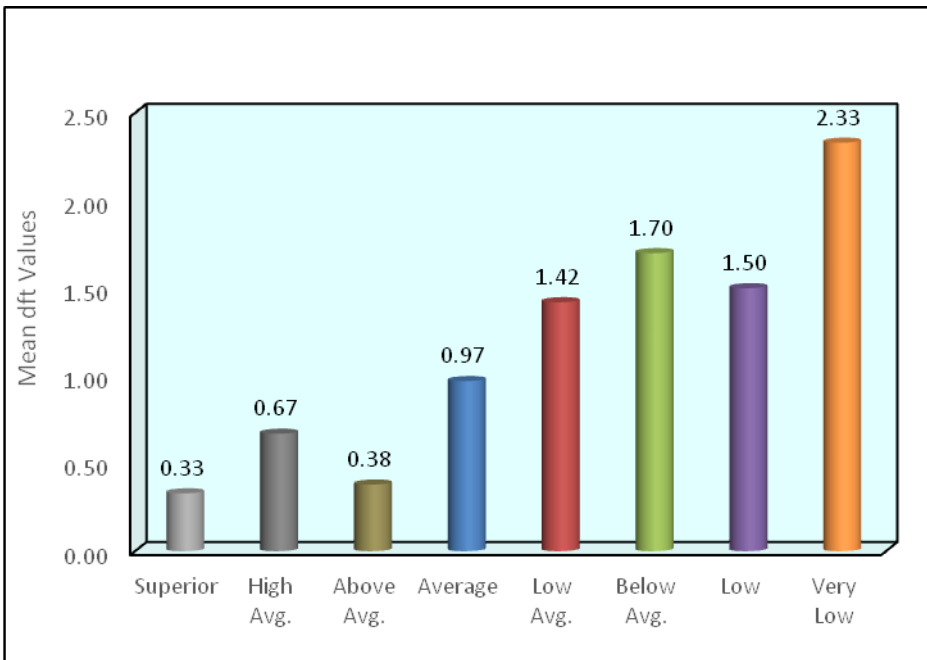
Variables	Self Concept	N	Mean	SD	Min	Max	P-Value <sup>a</sup>	Sig. Diff.	P-Value <sup>b</sup>
OHIS	High	51	1.25	0.39	0.6	2.6	<0.001*	H vs AA	<0.001*
	Above Avg.	103	1.80	0.54	0.5	3.4		H vs Av	<0.001*
	Average	46	2.19	0.60	1.0	3.3		AA vs Av	<0.001*
DMFT	High	51	1.10	0.96	0	3	<0.001*	H vs AA	<0.001*
	Above Avg.	103	2.13	0.93	0	4		H vs Av	<0.001*
	Average	46	2.70	0.96	1	4		AA vs Av	0.002*
deft	High	51	0.84	0.97	0	3	0.003*	H vs AA	0.002*
	Above Avg.	103	1.56	1.23	0	4		H vs Av	0.09
	Average	46	1.37	1.47	0	4		AA vs Av	0.65
GI	High	51	0.92	0.56	0	3	<0.001*	H vs AA	<0.001*
	Above Avg.	103	1.46	0.65	0	3		H vs Av	<0.001*
	Average	46	1.85	0.60	1	3		AA vs Av	0.001*



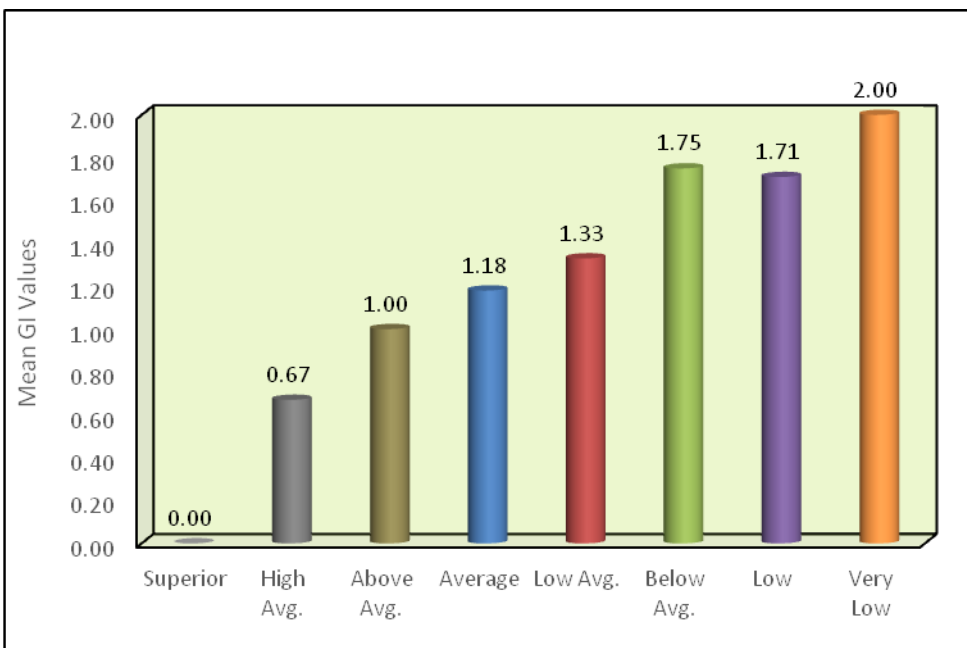
Graph 1 :Mean OHI-S scores based on IQ status among study subjects



Graph 2 : Mean DMFT scores based on IQ status among study subjects



Graph 3 : Mean dft scores based on IQ status among study subjects



Graph 4 : Mean GI scores based on IQ status among study subjects