Dietary Intake, Levels of Trace Elements and Intelligence Quotient (IQ) Among Huffaz Students from Selected Tahfiz Schools in Selangor

(Pengambilan Diet, Aras Unsur Surih dan Tahap Kecerdasan (IQ) dalam Kalangan Pelajar Tahfiz di Sekolah-Sekolah Tahfiz di Selangor)

FARAH WAHIDA IBRAHIM, NUR FARAHIN ABDUL RAHMAN, SANTIBUANA ABD RAHMAN, NOR MALIA ABD WARIF, DZALANI HARUN, AHMAD ROHI GHAZALI, HANIS MASTURA YAHYA, FAISAL ARIFFIN & SABRI MOHAMAD & ISMARULYUSDA ISHAK

ABSTRACT

Tahfiz education has been well accepted by Muslims in Malaysia. Memorizing the Quran through rote learning can assist in improving the brain ability to process, store information and build memory. In addition, dietary intakes were reported to contribute in the process of memorizing the Quran and to increase the levels of intelligence (IQ) among huffaz students. This cross-sectional study was conducted to measure and to determine the correlation between IQ and dietary intake as well as between IQ and the level of trace elements among students in selected tahfiz schools and non-tahfiz school in Selangor. Questionnaires were used to obtain demographic data. Dietary intake was assessed via 3 days dietary record. Levels of trace elements in the nail samples were analyzed by using ICP-MS. Test for intelligence using WASI-II was conducted to measure the students' IQ. The results showed that there was a moderate positive correlation between IQ and carbohydrate (r = 0.425, p < 0.001, a weak positive correlation between IQ and energy (r = 0.260, p < 0.05), vitamin B6 (r = 0.189, p < 0.05), vitamin B12 (r = 0.207, p < 0.05) and vitamin C (r = 0.211, p < 0.05). The levels of trace elements in nail samples showed no correlation with IQ, whereas there were moderate positive correlations between IQ and dietary zinc (r = 0.375, p < 0.001) as well as between IQ and dietary iron (r = 0.303, p < 0.001). There was also a moderate positive correlation between IQ and the level of memorization (r = 0.375, p < 0.001). The results of stepwise multiple linear regression showed that al-Quran memorization influence the level of IQ by 20 %. As a conclusion, dietary intake of certain nutrients including energy, vitamins and selected trace elements can potentially improve memorization activities and also IQ.

Keywords: Dietary intake; trace elements; intelligence; tahfiz; huffaz students

ABSTRAK

Pendidikan Tahfiz telah diterima dengan baik oleh umat Islam di Malaysia. Menghafal al-Quran dengan dengan teknik pengucapan berulang-kali dikatakan dapat membantu meningkatkan keupayaan otak untuk memproses, menyimpan maklumat dan membina ingatan. Di samping itu, pengambilan diet dilaporkan dapat menyumbang kepada proses menghafaz al-Quran dan meningkatkan tahap kecerdasan (IQ) di kalangan pelajar huffaz. Kajian keratan rentas ini dijalankan untuk mengukur dan mengenalpasti korelasi di antara tahap kecerdasan otak (IQ) dan pengambilan diet, dan di antara IQ dan tahap unsur surih di kalangan pelajar sekolah tahfiz dan bukan tahfiz di sekitar Selangor. Soal selidik digunakan untuk memperoleh data demografi. Pengambilan diet pelajar direkodkan selama 3 hari. Tahap unsur surih dalam sampel kuku dianalisis dengan menggunakan ICP-MS. Ujian kecerdasan WASI-II digunakan untuk mengukur IQ pelajar. Hasil kajian menunjukkan terdapat korelasi positif yang sederhana antara IQ dengan karbohidrat (r = 0.425, p < 0.001) manakala terdapat perkaitan yang positif dengan tenaga (r = 0.260, p < 0.05), vitamin B6 (r = 0.189, p < 0.05), vitamin B12 (r = 0.207, p < 0.05) dan vitamin C (r = 0.211, p < 0.05). Tahap unsur surih dalam sampel kuku tidak menunjukan sebarang perkaitan dengan IQ manakala terdapatnya korelasi positif yang sederhana antara IQ dan diet zink (r = 0.375, p < 0.001) dan diet ferum (r = 0.303, p < 0.001). Terdapat juga korelasi positif yang sederhana antara IQ dengan tahap hafalan (r = 0.375, p < 0.001). Hasil regresi linear berganda menunjukkan bahawa hafazan al-Quran mempengaruhi tahap IQ sebanyak 20%. Sebagai kesimpulan, pengambilan diet termasuk tenaga, vitamin dan unsur surih tertentu berpotensi meningkatkan tahap hafazan dan IQ pelajar.

Kata kunci: Pengambilan makanan; elemen surih; kecerdasan; tahfiz; pelajar huffaz

INTRODUCTION

The increase in the number of Tahfiz schools established by the government and private sectors indicates that Tahfiz education is becoming a favourable option in Malaysia. Parents also tend to send their children to Tahfiz schools with the hope of balancing their children's education in this world and the hereafter. Encouraging children to memorize

verses from the Quran with proper technique will improve their memory capability.

Listening is one of the crucial steps in memorizing. Listening to melodious Quran recitation is almost similar to listening to songs and music. It is relaxing and have been reported to reduce stress, anxiety and depression (Linnemann et al. 2015; Ghasemi et al. 2017). Memorization technique that is commonly used is repeated rehearsal of verbal material or rote learning. Increment in memorizing activities consequently increases the ability of the brain to process information, recall information and build long term-memory (Chandra & Levitin 2014; Kamal et al. 2013; Roche et al. 2009). The brain that is activated through memorization technique leads to neuroplasticity in the hippocampus, which is the learning and memory center of the brain (Roche et al. 2009). Through repetitions, the cognitive ability and the memory capability of the huffaz students can be increased. Therefore, memorizing Quran most probably can help and facilitate the learning of other subjects as well.

Taking nutritious food as part of the daily dietary intake is a great concern among huffaz and has been listed as part of the practicing etiquettes in memorizing Quran (Hashim et al. 2014). Micronutrients such as vitamins and minerals play important roles in our physical and mental health. Intake of micronutrients as dietary supplements is one of the ways to improve the IQ level (Schoenthaler et al. 1991). The structure of the brain in terms of its function, cognitive and intellectual can be affected by diet. In fact, most micronutrients such as trace elements and vitamins are assessed directly in the setting of cerebral function (Bourre 2006). The increase in the level of IQ is closely associated with dietary intakes that are largely due to good nutrition (Lynn 1990).

The aim of this research was to assess the dietary intake, levels of trace elements and IQ of huffaz students. The levels of trace elements and IQ were compared with the level of memorization, gender, age and types of schools. This study also determined the correlation between dietary intake, level of trace elements and IQ among students in tahfiz and non-tahfiz schools. Several factors that may potentially contribute to the level of IQ such as level of memorization, age, gender and dietary intake were also investigated.

MATERIALS AND METHODS

PARTICIPANTS

This cross-sectional study involved 131 students aged between 13 to 17 years old from 3 tahfiz schools and 1 non-tahfiz school in Selangor. Schools were selected using purposively sampling method and students were selected from a given name list through stratified sampling method. Ethics approval for this study was obtained from research ethics committee of Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2016-575). Permission to conduct the study

was given by the Ministry of Education Malaysia and Jabatan Agama Islam Selangor or JAIS. Parental written informed consent was obtained prior to participation in the study.

DISTRIBUTION OF QUESTIONNAIRES

The questionnaires which consisted of two sections were distributed to the students. The first section was on demographic data that includes gender, age, address, parents' occupation, Quran memorization information, and additional personal practice. The second section was on daily dietary intake.

COLLECTION OF NAIL SAMPLES

Fingernail samples were collected using stainless steel nail clippers. Nail clippers were cleaned using alcohol swab between samples to protect the students from getting infection and to avoid samples contaminations. Nail samples were kept in individually-coded airtight plastic bags and were kept in desiccators before being processed.

WASHING AND DIGESTION OF NAIL SAMPLES

A total of 0.03 g nails per sample was soaked in 10 ml of 0.5% Triton-X for 2 hours, followed by 8 ml acetone for 1 hour (Abdulrahman et al. 2012). Finally, the nails were rinsed with deionized water and dried overnight in the incubator at 60°C. The primary purpose of the digestion process is to completely solubilize the samples, resulting in the decomposition of the solid matrix. In this study, the acid digestion method was implemented through the use of nitric acid, HNO_3, in combination with peroxide, H_2O_2, to wash the samples (Mehra & Juneja 2004). The digested solutions were diluted by adding deionized water up to the volume of 10 ml and the resulting solutions were gently mixed. The solutions were then filtered into 15 ml polypropylene tubes and stored at 4°C until they were analyzed with Inductively Coupled Plasma Mass Spectrometry (ICP-MS) (Perkin Elmer, USA).

DIETARY INTAKE ASSESSMENT

The dietary intake was obtained using 3 days dietary recording method. Subjects were asked to record their dietary intake for 2 weekdays and 1 weekend. Examples of complete dietary records and pictures of household measurement were also given to the subjects as guidance (Shahar 2015). Data were collected using a reliable and validated instrument (Suzana et al. 2000), and entered into the Nutritionist Pro Diet Analysis for the determination of subjects' nutrient intakes and the level of dietary trace elements.

WASI-II test for intelligence was used to assess the level of intelligence quotient (IQ) of students (Wechsler & Hsiao-Pin 2011). WASI-II consists of four subtests which are block design, vocabulary, matric reasoning and similarities. Data produced from this test include Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI) and Full Scale IQ (FSIQ). This test took 40 to 45 minutes to be completed and was conducted in a closed room to avoid external disruption to the subjects during the test.

STATISTICAL ANALYSIS

All data was analyzed statistically with SPSS version 22.0. The results were considered significant with a p-value of < 0.05. All normally distributed data were presented as mean $\pm$ standard deviation. One way ANOVA was employed to compare all dependent variables according to level of memorizations. Independent T-test was employed to compare between gender and age groups. Pearson Correlation was employed for the association between two continuous variables. Lastly, Multiple Linear Regression was employed to determine the factors that mostly influenced IQ.

RESULTS

SOCIODEMOGRAPHIC DATA

A total of 131 subjects consisting of 59% male and 41% female participated in this study (Table 1).

TABLE 1. Distribution of sociodemographic data

	Frequency (n)	Percentage (%)
Total subjects	131	
Category		
Tahfiz	105	80.2
Non Tahfiz	26	19.8
Total juzuk for Tahfiz		
1-10	28	21.4
11-20	48	36.6
21-30	29	22.0
Gender		
Male	67	51.2
Female	64	48.8
Age		
15 years below	77	58.8
16 years above	54	41.2

DIETARY INTAKE

Overall dietary intake is shown in Table 2. Analysis of intake according to age and gender based on the Recommended Nutrient Intake for Malaysia 2017 (NCCFN

2017) revealed that the intake Vitamin A (133-193% for males and 147-156% for female), ferum (150-233% for male and 75.5-104% for female) and selenium (90-126% for males and 119-138% for female) were mostly more than 100% RNI. However the intake of zinc, potassium, phosphorus, vitamin B1, vitamin B2, vitamin C and dietary fiber were lower than the daily recommendation.

TABLE 2. Overall dietary intakes (N = 131)

Dietary Intake	Unit	Overall (Mean $\pm$ Std)
Energy	kcal	2047.1 $\pm$ 513.3
Carbohydrate	g/day	235.1 $\pm$ 61.0
Fat	g/day	90.2 $\pm$ 29.0
Protein	g/day	74.8 $\pm$ 22.0
Vitamin A	µg/day	953.9 $\pm$ 450.7
Vitamin B1	mg/day	0.7 $\pm$ 0.2
Vitamin B2	mg/day	1.0 $\pm$ 0.3
Vitamin B3	mg/day	10.1 $\pm$ 3.4
Vitamin B6	mg/day	1.0 $\pm$ 0.4
Vitamin B12	mg/day	2.5 $\pm$ 1.7
Vitamin C	mg/day	37.0 $\pm$ 27.2
Vitamin E	mg/day	4.7 $\pm$ 1.8
Zinc	mg/day	4.7 $\pm$ 2.1
Iron	mg/day	21.2 $\pm$ 10.8
Selenium	µg/day	33.1 $\pm$ 14.8

LEVELS OF DIETARY AND NAIL TRACE ELEMENTS ACCORDING TO THE LEVELS OF MEMORIZATION, GENDER AND AGE

The overall level of zinc was 4217 ± 1274 µg/L. Iron level was 1516 ± 305 µg/L and selenium was 26.41 ± 12.13 µg/L. Comparison of the trace element levels according to the level of memorization, gender and age group was as shown in Table 3. The levels of dietary zinc and iron were significantly high in subjects who already memorized the Quran in category 21 to 30 juzuk ($p < 0.001$). The level of dietary iron was significantly higher among males ($p < 0.05$). There was a significant difference between dietary zinc ($p < 0.05$) and iron ($p < 0.05$) according to age group. However, there was no significant difference of dietary selenium according to memorization level ($p = 0.474$), gender ($p = 0.218$) and age ($p = 0.432$).

LEVELS OF INTELLIGENCE (IQ)

The results for Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI) and Full Scale IQ (FSIQ) were compared between subjects from tahfiz and non-tahfiz schools (Table 4). VCI for subjects from the non-tahfiz school was slightly higher than the subjects from the tahfiz schools. Meanwhile, PRI was higher in subjects from the tahfiz schools as compared to those from non-tahfiz school.

TABLE 3. Levels of trace elements according to levels of memorization, gender and age groups

	Levels of Memorization			Gender		Age groups	
	1-10	11-20	21-30	Male	Female	13-15 years	16-17 years
Dietary Trace Elements (mg)	(n = 28)	(n = 48)	(n = 29)	(n = 67)	(n = 64)	(n = 77)	(n = 54)
Zinc	4.11 ± 1.82	4.09 ± 1.63	5.99 ± 2.42***	5.10 ± 2.42	4.36 ± 1.76	4.40 ± 2.06	5.22 ± 2.18*
Iron	21.11 ± 9.72	16.95 ± 7.36	25.39 ± 9.56***	23.12 ± 11.51	19.33 ± 9.72	19.60 ± 10.25	23.65 ± 11.22*
Selenium	33.41 ± 14.51	31.89 ± 14.33	29.13 ± 11.67	34.75 ± 14.87	31.55 ± 14.68	32.33 ± 15.07	34.41 ± 14.48
Nail Trace Elements (µg/L)	(n = 7)	(n = 11)	(n = 8)	(n = 19)	(n = 17)	(n = 19)	(n = 17)
Zinc	3602 ± 1056	3344 ± 896	4248 ± 1443	3556 ± 1204	4409 ± 1420	3930 ± 1212	3991 ± 1549
Iron	1278 ± 408	987 ± 524	1393 ± 306	1274 ± 449	1186 ± 497	1237 ± 503	1228 ± 439
Selenium	25.55 ± 17.87	30.26 ± 14.18	32.23 ± 12.39	27.80 ± 14.99	33.11 ± 13.68	30.86 ± 14.32	29.68 ± 14.95

*$p < 0.05$, ***$p < 0.001$

TABLE 4. Levels of VCI, PRI and FSIQ according to tahfiz and non-tahfiz school

	Tahfiz School N = 105	Non-Tahfiz School N = 26
VCI	102.98 ± 13.96	109.61 ± 12.14
PRI	103.05 ± 19.79	84.65 ± 8.68
FSIQ	103.77 ± 15.77	97.00 ± 8.70

FSIQ was observed higher in subjects from tahfiz schools compared to subjects from non-tahfiz school. The results in Table 5 showed that the level of FSIQs were significantly higher among students who memorized the Quran in the highest category of 21 to 30 juzuk (p < 0.001).

TABLE 5. Levels of FSIQ according to levels of memorization

	Levels of Quran Memorization			Gender		Age groups	
	1-10 (n = 28)	11-20 (n = 48)	21-30 (n = 29)	Male (n = 67)	Female (n = 64)	13-15 years (n = 77)	16-17 years (n = 54)
FSIQ	96.00 ± 11.49	104.00 ± 16.04	110.89 ± 15.85***	105.02 ± 15.99	99.70 ± 13.15*	99.75 ± 14.00	106.24 ± 15.33*

*p < 0.05, ***p < 0.001

CORRELATION BETWEEN DIETARY INTAKE, LEVEL OF TRACE ELEMENTS AND IQ

The results revealed a weak positive correlation between nail zinc and IQ level (r = 0.040, p = 0.818) and nail iron with the IQ level (r = 0.267, p = 0.115) (Table 6). Meanwhile, there was a moderate positive correlation between the levels of IQs with dietary zinc and iron which were (r = 0.375, p < 0.001) and (r = 0.303, p < 0.001) respectively. Meanwhile, dietary selenium showed a weak positive correlation with the IQ level (r = -0.125, p = 0.156).

Table 6 shows the correlation between levels of FSIQs with dietary intakes using Pearson correlation test. There was a significantly moderate positive correlation between the level of IQ with carbohydrate (r = 0.426, p < 0.001), and significantly weak positive correlations between the levels of IQs with energy (r = 0.260, p = 0.003), vitamin B6 (r = 0.189, p = 0.030), vitamin B12 (r = 0.207, p = 0.018) and vitamin C (r = 0.211, p = 0.016).

Table 7 shows that dietary zinc and iron have significantly weak positive correlation and moderately positive correlation with the level of Quran memorization which was (r = 0.238, p < 0.001) and (r = 0.342, p = 0.014) respectively. However, selenium has a weak negative correlation with the level of Quran memorization. The results indicate that there was a moderate positive correlation between the level of IQ with the level of Quran memorization (r = 0.375, p < 0.001).

TABLE 6. Association between levels of FSIQ with levels of trace elements and dietary intake

		r value	p value
Nail Trace Element	Zinc	0.040	0.818
	Iron	0.267	0.115
	Selenium	-0.038	0.826
Dietary Nutrients and Trace Element	Zinc	0.375	p < 0.001*
	Iron	0.303	p < 0.001*
	Selenium	-0.125	0.156
	Energy	0.260	0.003
	Carbohydrate	0.426	p < 0.001*
	Protein	0.056	0.528
	Vitamin A	0.170	0.052
	Vitamin B1	0.146	0.095
	Vitamin B2	0.104	0.237
	Vitamin B3	0.219	0.012*
	Vitamin B6	0.189	0.030*
	Vitamin B12	0.207	0.018
	Vitamin C	0.211	0.016*
	Vitamin E	0.099	0.260

*Significant correlation p < 0.05

TABLE 7. Association between levels of memorization with dietary trace elements

	Dietary Trace Element	r value	p value
Levels of Quran Memorization	Zinc	r = 0.238	p < 0.001***
	Iron	r = 0.342	p = 0.014*
	Selenium	r = -0.132	p = 0.180

*p < 0.05, ***p < 0.001

FACTORS AFFECTING THE LEVEL OF INTELLIGENCE (IQ)

Multiple linear regression "stepwise" was employed to determine the factors that profoundly affect FSIQ. The independent variables were the page number of Quran memorization, age, nail iron, dietary zinc and iron, and dietary intakes such as carbohydrate, energy, vitamin B1, vitamin B6, vitamin B12 and vitamin C. The results produced a model equation of IQ = 86.937 + 0.041 (number of pages of Quran memorization) with coefficient value of determination of 0.2. Based on the results, it was found that only variable level of Quran memorization was included in the regression equation and this variable can explain 20 percent of the variability in the level of intelligence (IQ),

$F(1,24) = 6.337$, $p < 0.05$. In short, the memorization of one page of the Quran could increase the IQ level to 0.041.

DISCUSSION

This study indicates that the dietary intake of vitamin C, vitamin E, vitamin B1, vitamin B3, zinc and iron according to NCCFN (2017) for certain students were slightly lower. In the study concerning dietary intakes of the subjects, the consumption of zinc, potassium, phosphorus, vitamin B1, vitamin B2, vitamin C and dietary fibers were lower than the daily recommendation. This could be translated to imbalanced diet lacked of vegetables and fruits (Kumari & Leong 2002). The intake of vegetables was not able to be analyzed since the subjects did not mention specifically the type of vegetables they consumed. The intake of vitamin E among the subjects might be considered as low due to the intake of certain vitamins including vitamin E that actually requires 20 days of daily dietary records to obtained the general picture of diet intakes (Livingstone et al. 2004). Foods that are rich in zinc include beef, chicken and organ meats (beef, chicken), fish and shell (Mohd Shariff 2005). According to IZiNCG (2004), liver and kidney (beef, chicken and duck) contain the highest amount of zinc with 4.2-6.1 mg for every 100 g. All subjects from the selected schools did not consume these foods in their diet. Furthermore, they rarely took beef. Hence, zinc intake was low. Chicken was the main source of zinc in the subjects' diet. On top of that, another factor that may contribute to the dietary intake below the daily recommendation was the dietary intake recording technique taken by the subjects. Self-reported dietary intake particularly among adolescents may be biased, in terms of under-reporting of food intake. Therefore, the most appropriate action when assessing nutrient intake data is to assume the data reported is the minimum actual intake (Livingstone et al. 2004).

VCI intelligence test results were higher in subjects from the tahfiz schools while PRI was higher in the subjects from the non-tahfiz school. Crystallized intelligence that was measured by the VCI is associated with the acquisition of skills and knowledge that not only gained through education in school but also through daily experience. Through training and experience, the children develop their knowledge and skills. Factors such as motivation and the quality of teaching were also taken into consideration. Motivation level of subjects during the IQ test can affect their performance. The quality of teaching in schools can also influence the acquisition of vocabulary by the subjects. Fluid intelligence that was measured through PRI is associated with thinking ability, memory and information processing capacity and the ability to solve abstract problems in new situations. PRI is largely inherited and less influenced by training (Thorsen et al. 2014). Although Catell's theory of intelligence stated that intelligence is not affected by training (Thorsen et al. 2014), a study that has been conducted by Jaeggi et al. (2008) found that fluid intelligence can be improved through training on the working memory. The training conducted in the study was called "dual n-back" that involved executive process in which respondents were asked to inhibit irrelevant items, monitoring ongoing performance, managing two tasks simultaneously and update the visual in memory. The process that was carried out is similar to the process undertaken by individuals who memorized the Quran. The subjects not only required to recite the Quran in the right way and memorizing verses, they also have to memorize them by constantly repeat and updating the memorized verses. These activities helped to increase the capacity of working memory among huffaz subjects which may explain the effect of Quran memorization on PRI.

Full scale IQ (FSIQ) was observed higher in huffaz subjects. According to a study conducted by Shirvani et al. (2015) in primary students, the level of IQ of tahfiz subjects was higher than non-tahfiz subjects. This study describes the role of Quran centered education that trains new methods to improve social development and ethical reasoning, improves memory and develop life skills among students compared to traditional learning and training.

The comparison of IQ level according to the level of Quran memorization revealed that the highest IQ score was observed in subjects who have memorized 21 to 30 juzuk. There was a moderate positive correlation between the level of IQ with the level of Quran memorization. A review by Mahjoob et al. (2016) describes the role of the Quran in reducing anxiety, giving inner peace and enhances individual acceptations capacity, thereby improving their learning process. Juping et al. (2013) stated that those who memorized the verses of Quran have strong memory. The huffaz were able to memorize the Quran, stored the verses in their memory and recalled them from their memory. This supports the increase in fluid intelligence (PRI) through the training of the working memory. Furthermore, the Quran memorizing skills help to improve memory retention of information that might not be related to the Quran verses stored in the brain memory (Nosrati & Karami 2013). Therefore, the acquisition of vocabulary through learning in schools and daily experiences are also associated with the Quran memorizing skills.

Total food intakes and calories (energy) are the most significant factors associated with the effect of dietary intake on cognitive function. In addition, dietary intakes containing antioxidants such as vitamin C and vitamin E was associated with cognitive function (Crichton et al. 2013). Iron homeostasis is essential for normal brain function especially in learning and memory (Loh 2005). Iron status is highly related to the sub-test block design in WASI-II test and spatial test (Brown 2001). According to Chou et al. (2001), zinc plays a role in cognitive development. Food source containing selenium can improve emotions. The brain works more efficiently when someone is in a good mood and it will also assist in the psychological aspect (Benton 2002). However in this study, the correlation between selenium and IQ cannot be observed.

The results of multiple linear regressions "stepwise" indicate that the level of Quran memorization influenced the level of IQ by 20%. Memorizing the Quran by only one page increased the IQ by 0.041. In short, if a person memorizes 100 pages of Quran (which is equals to five juzuk of Quran), the IQ level hypothetically will be increased by four points. This model predicted that if a student with the IQ level of 87 (low average category) have successfully memorized 5 juzuk of the Quran, his IQ level would increase to 4 points with a total score of 91. This student then would actually belong to the average category.

CONCLUSION

From this study, it can be concluded that the intake of zinc (trace elements) together with carbohydrates, energy, vitamin B6, vitamin B12 and vitamin C influence the level of IQ. Students who have memorized more verses of Quran also have higher level of IQ. The results of multiple linear regression revealed that the factor that contributed to the level of IQwas the level of Quran memorization.

ACKNOWLEDGEMENT

REFERENCES

Abdulrahman, F., Akan, J., Chellube, Z. & Waziri, M. 2012. Levels of heavy metals in human hair and nail samples from Maiduguri Metropolis, Borno State, Nigeria. *World Environment* 2(4): 81-89.

Benton, D. 2002. Selenium intake, mood and other aspects of psychological functioning. *Nutritional Neuroscience: An International Journal on Nutrition, Diet and Nervous System* 5(6): 363-374.

Bourre, J.M. 2006. Effects of nutrients (in food) on the structure and function of the nervous system: update on dietary requirements for brain.Part 2 : Macronutrients. *The Journal of Nutrition, Health and Aging* 10(5): 386-399.

Brown, D. 2001. Link between iron and youth cognitive skills? *Journal of the American Dietetic Association* 101: 1308-1309.

Chandra, M.L. & Levitin, D.J. 2014. The neurochemistry of music. *Trends in Cognitive Sciences* 17(4): 179-193.

Chou, H., Chien, C., Huang, H. & Lu, K. 2001. Effects of zinc deficiency on the vallate papillae and taste buds in rats. *Journal of the Formosan Medical Association* 100: 326-335.

Crichton, G.E., Bryan, J. & Murphy, K.J. 2013. Dietary antioxidants, cognitive function and dementia--a systematic review. *Plant Foods for Human Nutrition* 68(3): 279-292.

Ghasemi, M., Lotfollahzadeh, H., Kermani-Ranjbar, T. & Kharazifard, M.J. 2017. Effect of Music Practice on Anxiety and Depression of Iranian Dental Students. *Journal of Dentistry (Tehran)* 14(3): 138-143.

Hashim, A., Tamuri, A.H. & Che Noh, M.A. 2014. The relationship between etiquettes of thafiz (memorization Al-Quran) and tahfiz achievement. *Australian Journal of Basic and Applied Sciences* 8(23) Special 2014: 212-218.

IZiNCG. 2004. Assessment of the risk of zinc deficiency in populations and options for its control. International zinc nutrition consultative group technical document. *Food Nutrition Bulletin* 25(1): 94-203.

Juping, O., Kassim, N. & Badrasawi, K., 2013. Motivation and arabic learning achievement: A comparative study between two types of islamic schools in Gansu, China. *Proceedings of Pacific Rim Objective Measurement Symposium (PROMS)* 8: 197-217.

Kamal, N.F., Mahmood, N.H. & Zakaria, N.A. 2013. Modeling brain activities during reading working memory task: Comparison between reciting Quran and reading book. *Procedia- Social and Behavioral Sciences* 9: 83-89.

Kumari, N. & Leong, L.P. 2002. Dietary intakes of school children. *National University of Singapore*. 1-4

Linnemann, A., Ditzen, B., Strahler, J., Doerr, J.M. & Nater, U.M. 2015. Music listening as a means of stress reduction in daily life. *Psychoneuroendocrinology* 60: 82-90.

Livingstone, M.B.E., Robson, P.J. & Wallace, J.M.W. 2004. Issues in dietary intake assessment of children and adolescents. *British Journal of Nutrition* 92(2): 211-222.

Loh, S.P. 2005. Chapter 15: Iron. Noor M.S, Khor G.L & Tee E.S (Ed.). *Nutritional Daily Intake for Malaysia*: 154-163. Shah Alam: YKL Print.

Lynn, R. 1990. The role of nutrition in secular increases in intelligence. *Personal and Individual Difference* 11: 272-85.

Mahjoob, M., Nejati, J., Hosseini, A., Bakhshani, N. 2014. *The effect of holy Quran voice on mental health. Journal of Religion and Health* 14: 147-153.

Mehra, R. & Jenuja, M. 2004. Biological monitoring of lead and cadmium in human hair and nail and their correlations with biopsy materials, age and exposure. *Indian Journal of Biochemistry and Biophysics* 41(1): 53-56.

Mohd Shariff. 2005. Chapter 17: Zinc. Noor M.S, Khor G.L & Tee E.S (Editors). Nutritional Daily Intake for Malaysia: 177-190. Shah Alam: YKL Print.

National Coordinating Committee On Food And Nutrition (NCCFN) 2017. *Recommended Nutrient Intakes for Malaysia RNI: A Report Of The Technical Working Group On Nutritional Guidelines.* Putrajaya: Ministry Of Health Malaysia.

Nosrati, K. & Karami, N.R. 2013. Assessment of kinds of memory among keeper and no keeper students. *New Cognitive Sciences* 4: 12-26.

Roche, R.A., Mullally, S.L., McNulty, J.P., Hayden, J., Brennan, P., Doherty, C.P., Fitzsimons, M., McMackin, D., Prendergast, J., Sukumaran, S., Mangaoang, M.A., Robertson, I.H. & O'Mara, S.M. 2009. Prolonged rote learning produces delayed memory facilitation and metabolic changes in the hippocampus of the ageing human brain. *BMC Neuroscience* 10: 136 doi: 10.1186/1471-2202-10-136

135

Schoenthaler, S.J., Amos, S.P., Doraz, W.E., Kelly, M.A & Wakefield, J. 1991. Controlled trial of vitamin-mineral supplementation on intelligence and brain function. *Personal and Individual Difference* 12: 343-50.

Shahar, S. 2015. *Atlas Makanan: Saiz Pertukaran dan Porsi*. Kuala Lumpur: MDC Publisher Sdn. Bhd.

Shirvani,M., Heidari, M., Shahbazi, S., Sheikhi, R.A., Borujeni, M.B. & Mancheri, H. Comparison of intelligence test results among hafiz and non-hafiz of holy quran students at their entrance to schools. *International Journal of Review in Life Sciences* 5(8): 1105-1109.

Suzana, S., Earland, J. & Suriah, A. R. 2000. Validation of a Dietary History Questionnaires against a 7-D Weighed Record for Estimating Nutrient Intake among Rural Elderly Malay. *Malaysian Journal of Nutrition* 6: 33-34.

Thorsen, C., Gustafsson, J.E. & Cliffordson, C. 2014. The influence of fluid and crystallized intelligence on the development of knowledge and skills. *British Journal of Educational Psychology* 84: 556-570.

Wechsler, D. & Hsiao-Pin, C. 2011. *WASI-II: Wechsler abbreviated scale of intelligence*. San Antonio: Pearson.

Farah Wahida Ibrahim
Santibuana Abd Rahman
Nor Malia Abd Warif
Ahmad Rohi Ghazali
Faisal Ariffin
Ismarulyusda Ishak
Biomedical Science Programme
School of Healthcare Sciences, Faculty of Health Sciences
UKM Kuala Lumpur.

Nur Farahin Abdul Rahman
Environmental Health and Industrial Safety Programme
School of Diagnostic & Applied Health Sciences

Dzalani Harun,
Occupational Therapy Programme
School of Rehabilitation Sciences

Hanis Mastura Yahya
Nutritional Sciences Programme
School of Healthcare Sciences, Faculty of Health Sciences
UKM Kuala Lumpur.

Sabri Mohamad
Department of Al-Quran and Al-Sunnah Studies
Faculty of Islamic Studies, UKM Bangi

Corresponding author: Ismarulyusda Ishak
Email: ismarul@ukm.edu.my
Tel: +603-92897615
Fax: +603-26929032