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Assessment of the Amino Acids Profiles Linked to Hearing Loss among Saudi Students at the University of Hail, Kingdom of Saudi Arabia

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Abstract Nearly 16 million Americans have been affected by hearing loss. There are a number of causes of hearing loss including a deficiency in the intake of a number of amino acids such as methionine, Arganine, Carnitine, Glutathione and Taurine. A lot of the studies that have been written for nutritional amounts of amino acids on a day to day basis have been written for the western world, However studies looking at Saudi adolescents especially between the ages of 18-21 are lacking. The study was designed to determine whether a dietary intake of certain amino acids linked to deafness was deficient in 18-21 year-old Saudi Arabian adolescents. The study objectives were to describe the food habits, especially in terms of amino acid consumption of 18-21-year-old adolescents, in Hail, KSA (Kingdom of Saudi Arabia) and determine if these dietary habits are related to hearing loss. Assessment if any of any amino acid deficiency as well as current knowledge of the beneficial effects of certain amino acids in hearing will also be assessed. Aims relating to food intake were assessed by a food questionnaire. The other aims were answered by further survey questions. Two thirds (61.3%) of the females consumed chocolate on a daily basis. This was also the highest food item consumed by the hard of hearing students. Chocolate being a rich source of arganine was beneficial to the students being important for the formation of functional gap junctions in the inner ear. In this study no amino acids were deficient in our population. However, further studies are required to look at the effect of redundant amino acids and their impact on deafness. The Dietary intake of the amino acids linked to deafness is adequate for the students in this study. The students felt the knowledge of amino acids in deafness would help their families in the long term.

Keywords: *amino acids, hearing loss, adolescents, deficiency*

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1. Introduction

Nearly 16 million Americans have been affected by hearing loss, ranging from temporary to permanent or from partial to complete [1]. Hearing loss may result from the dysfunction of any part of the auditory system. Possible causes of hearing loss include disease (genetic or infectious), allergies, exposure to noise (either chronic or a single event), ototoxic drugs, polyps, tumors, brain injury, and injury to the cochlear nerve.

Deficiency in the intake of a number of amino acids can also lead to hearing deficiencies. Arginine, an essential amino acid. In addition to the benefits often associated with arginine (e.g., in hypertension and age-related protein synthesis), studies have indicated that arginine is protective against sensorineural hearing loss (that is the hearing loss that affects the inner ear or the eighth cranial nerve) and cochlear damage caused by the toxins that are produced in Streptococcus pneumoniae infections [2]. Pretreatment with arginine was found to provide cochlea protection.

Carnitine is an amino acid recognized as an effective antiaging therapy. However, the results of one study suggest that carnitine can have beneficial effects on diabetes associated central neuropathy [3]. The diabetes-induced brain stem auditory evoked potentials (BAEP) deficits were improved after carnitine treatment.

Methionine is an antioxidant amino acid. It has been found to have important protective benefits from various types of ototoxic hearing loss: Aminoglycoside-induced hearing loss [4]. Ionic platinum compounds, the therapy most commonly used to treat metastic tumors [5]. Cisplatin, an effective agent used in the treatment of squamous cell cancer of the head and neck [6,7].

In Cuba from 1992-1993 there was an epidemic outbreak of peripheral neuropathy, affecting over 50,000 people, some of which displayed sensorineural deafness. The deafness produced was of a high-frequency. Obvious malnutrition was not present, but a deficit in

micronutrients including methionine appeared to be a primary determinant of the epidemic [8].

Glutathione is another amino acid that has been shown to have protective benefits against hearing loss associated with acoustic overstimulation [9]. A depleted glutathione state increased noise-induced hearing loss, whereas replenishment of glutathione lessened the damage [9,10]. Glutathione was also protective for gentamicin ototoxicity, particularly when the diet was low in protein [11].

Taurine is described as one of the "conditionally essential" amino acids. Absence of a conditionally essential nutrient may not cause an immediate deficiency disease, but deficiency can cause problems in the long term, particularly in preterm and term infants [12,13,14,15]. Infants with inadequate taurine in their diets had shorter auditory brain stem responses [15]. In animal studies, taurine-supplemented diets resulted in maturation of the brainstem auditory response earlier, leading Vallecalle-Sandoval et al. [16] to suggest that taurine plays "an important role in the anatomical and functional development of the auditory system." Because taurine is defined as a "conditionally essential" amino acid, the clinical consequences that arise from taurine deficiency are reversible with taurine supplementation [14].

The profile of amino acids is needed to diagnose and manage some disease states due to imbalanced protein metabolism, as well as to evaluate the nutritional status of an individual. Mager *et al.* have shown that the estimated mean requirements of the branched chain amino acids in school children aged 6-10 years old determined by Indicator Amino Acid Oxidation (IAAO) method is significantly higher (~48%) than the current FAO/WHO/UNU recommendations [17,18].

Another study conducted by Riazi and co-workers on healthy young adults showed a higher mean population requirement for the branched chain amino acids than established by FAO/WHO/UNU [19,20]. The higher dietary protein intake is shown to be valuable for satiety and reduced net food intake [21,22].

One of the most popular foods among adolescents in the western world is high energy Western fast food for meals or snacking [23,24].

In the Kingdom of Saudi Arabia, the traditional diet characterized by high fiber content and low fat and cholesterol has changed to a more Westernized diet with high levels of fat, free sugars, sodium, and cholesterol [25,26]. Daily per capita fat consumption has shown a drastic increase in most Middle Eastern countries, ranging from 13.6% in Sudan to 143.3% in Saudi Arabia. Also, the consumption of fiber-rich foods such as whole grains, vegetables, and fruits is low. Data from food composition tables in the region showed that sodium amounts in the Middle Eastern diet is high [27,28].

A lot of studies have been written for the intake of amino acids on a day to day basis in the western world. However studies looking at Saudi adolescents especially between the ages of 18-21 are lacking.

2. Aims

The study was designed to determine whether a dietary intake of certain amino acids linked to deafness was deficient in 18-21 year-old Saudi Arabian adolescents.

* The study objectives were to describe the food habits, especially in terms of amino acid consumption of 18-21-year-old adolescents, in Hail, KSA.

* Determine if these dietary habits are related to hearing loss.

* Assessment if any of any amino acid deficiency.

* Assess participant knowledge of the beneficial effects of certain amino acids in hearing.

3. Material and Methods

3.1. Subjects

In this cross-sectional study, a total of 100 (female students) apparently healthy Saudi volunteers, aged 18-21 years were recruited from the University of Hail, Hail, and KSA using a randomized sampling technique.

3.2. Ethical Approval

Written informed consent was obtained prior to the Study. Ethical approval was granted by the College of Science's Ethics Committee, University of Hail, Hail, and Saudi Arabia.

3.3. Samples Collection

A structured questionnaire was used to collect information from subjects on age, family history, medical history, and usual dietary habits.

The questionnaires used were in Arabic. The data collected from the questionnaires was translated into English. All interviews were conducted by the research students in the project.

The Appendix presents the major questions for each group of interviewees and the interview questions.

3.4. Assessment of Dietary Intake

Dietary intake was assessed using a 24 hour food recall method and a food frequency questionnaire [29]. To ensure validity, reliability and reproducibility, a face-to-face standard interview was conducted with the subjects instead of the conventional self-administered questionnaire.

3.5. Statistical Analysis

We used a Chi Squared test for the two groups of yes and no responses to test for differences in female students to the questions in the survey. The level of significance in a chi-square for a two-tailed 1-df test was a value of 3.84 or greater.

4. Results

Six sets of results will be presented. First, dietary intake of amino acids among normal students and secondly, among hearing deficient students.

Third the distribution of hearing loss in our population surveyed. Fourth knowledge of deafness and its relationship to amino acids among the students. Fifth analysis of Amino acid deficiency symptoms among our students and sixth the dietary intake of fast food among normal and hard of hearing students.

Table 1. The intake of amino acids in certain foods among the students at the University of Hail. Each first column is the frequency of the food intake by the number of students out of a total of 83. Each row denotes the food item consumed. The second column denoted by the * is the percentage change in relation to the total number of students

Type and Frequen	Dail y	Percent change *	Ever y other day	Percent change *	Thre e times a day	Percent change *	Two time s day	Percent change *	Onc e a day	Percent change *	Rarel y	Percent change *	neve r	Percent change *
Nuts	11	13.3	24	28.9	4	4.8	1	1.2	6	7.2	33	39.8	3	3.6
Sunflowe r seeds	4	4.8	20	24.1	4	4.8	2	2.4	3	3.6	34	41	13	15.7
Chocola	51	61.4	6	7.2	5	6	8	9.6	9	10.8	5	6	4	4.8
Raisons	6	7.2	3	3.6	1	1.2	5	6	6	7.2	17	20.5	22	26.5
Brown rice	5	6	3	3.6	6	7.2	2	2.4	2	2.4	24	28.9	30	36.1
Red meat	20	24.1	19	22.9	2	2.4	3	3.6	12	14.5	20	24.1	5	6
Dairy	22	26.5	18	21.7	7	8.4	3	3.6	14	16.9	18	21.7	5	6
fish	2	2.4	18	21.7	3	3.6	4	4.8	1	1.2	26	31.3	11	13.3
eggs	14	16.9	27	32.5	1	1.2	3	3.6	6	7.2	17	20.5	4	4.8
chicken	37	44.6	19	22.9	3	3.6	5	6	3	3.6	7	8.4	1	1.2
Red peppers	20	24.1	21	25.3	2	2.4	1	1.2	6	7.2	14	16.9	15	18.1
garlic	11	13.3	12	14.5	2	2.4	4	4.8	4	4.8	20	24.1	25	30.1
onion	20	24.1	11	13.3	7	8.4	2	2.4	2	2.4	11	13.3	23	27.7
Starche	32	38.6	14	16.9	4	4.8	4	4.8	4	4.8	4	4.8	7	8.4
brocolli	6	7.2	7	8.4	1	1.2	2	2.4	6	7.2	16	19.3	29	34.9
Brussel sprouts	4	4.8	4	4.8	3	3.6	3	3.6	3	3.6	18	21.7	28	33.7
Oats	10	12	8	9.6	4	4.8	6	7.2	1	1.2	25	30.1	20	24.1
granola	4	4.8	14	16.9	4	4.8	5	6	6	7.2	23	27.7	24	28.9
Wheat germ	3	3.6	9	10.8	11	13.3	2	2.4	3	3.6	21	25.3	27	32.5
Sprouted lentils	6	7.2	15	18.1	1	1.2	7	8.4	8	9.6	15	18.1	14	16.9
Fresh	28	33.7	18	21.7	4	4.8	2	2.4	9	10.8	6	7.2	5	6
Fresh Vegeta bles	26	31.3	19	22.9	1	1.2	5	6	3	3.6	13	15.7	7	8.4

Table 2. The intake of amino acids in certain foods among the hard of hearing students at the University of Hail. Each first column is the frequency of the food intake by the number of students out of a total of 83. Each row denotes the food item consumed. The second column denoted by the * is the percentage change in relation to the total number of students

Type and Frequen	Daily	Percent change	Every other day	Percent change	Three times a day	Percent change	Two times day	Percent change	Once a day	Percent change	Rarely	Percent change	never	Percent change
Nuts	0	0	0	0	0	0	1	1.1	2	2.3	0	0	1	1.1
Sunflower seeds	0	0	0	0	0	0	1	1.1	0	0	2	2.3	4	4.5
Chocola	4	4.5	0	0	0	0	0	0	1	1.1	0	0	0	0
Raisons	0	0	0	0	0	0	0	0	0	0	3	3.4	1	1.1
Brown rice	3	3.4	1	1.1	0	0	0	0	2	2.3	0	0	1	1.1
Red meat	1	1.1	0	0	0	0	1	1.1	2	2.3	0	0	0	0
Dairy	3	3.4		0	0	0	0	0	0	0	0	0	1	1.1
fish		0	1	1.1	0	0	0	0	2	2.3	0	0	0	0
eggs	1	1.1	0	0	3	3.4	1	1.1	0	0	0	0	0	0
chicken	3	3.4	0	0	0	0	0	0	1	1.1	0	0	0	0
Red peppers	1	1.1	0	0	0	0	0	0	2	2.3	0	0	2	2.3
garlic	3	3.4	0	0	0	0	0	0	0	0	0	0	2	2.3
onion	4	4.5	0	0	0	0	0	0	0	0	0	0	1	1.1
Starches	1	1.1	3	3.4	0	0	0	0	0	0	1	1.1	0	0
brocolli	0	0	0	0	1	1.1	0	0	0	0	1	1.1	1	1.1
Brussel sprouts	0	0	0	0	0	0	1	1.1	0	0	1	1.1	3	3.4
Oats	1	1.1	0	0	0	0	0	0	0	0	0	0	3	3.4
granola	1	1.1	0	0	2	2.3	1	1.1	1	1.1	0	0	0	0
Wheat germ	1	1.1	0	0	0	0	0	0	0	0	1	1.1	2	2.3
Sprouted lentils	2	2.3	0	0	0	0	0	0	2	2.3	0	0	2	2.3
Fresh	3	3.4	0	0	0	0	0	0	0	0	0	0	0	0
Fresh Vegeta bles	5	5.7	0	0	0	0	0	0	0	0	0	0	0	0

Table 1 shows the dietary intake of certain foods rich in amino acids among the students at the University of Hail. It is worth noting that two-thirds (61.3%) females consumed chocolate on a daily basis. This was also up to two times a day with 9.6% of the students and once a day for 10.6% of the students. Chicken and starches were the next most popular food on a daily basis among the students showing percentages of 38.6 % and 44.6% respectively. Every other day eggs and nuts were the most popular food eaten with values of 32.5% and 28.9% respectively.

Foods rarely eaten by the students include sunflower seeds, fish and oats with percentages of 41%, 31.3% and 30.3% respectively. Foods never eaten by the students include brown rice, broccoli, Brussels sprouts and granola with values of 36.1%, 34.9%, 33.7% and 28.9% respectively. Dairy was the most popular food eaten three times a day with a value of 8.4%. Red meat (14.5%) was eaten at least once a day by the students.

Table 2 shows the dietary intake of certain foods rich in amino acids among the deaf students at the University of Hail. It is worth noting that 4.1% females consumed chocolate on a daily basis. Brown rice and dairy were the next highest food stuffs taken with values of 3.4% and 3.4% respectively. Every other day starches were the most popular food eaten with a value of 3.4%. Eggs were eaten three times a days by the students (3.4%). Nuts and red meat were eaten at least once a day by the students with values of 2% respectively.

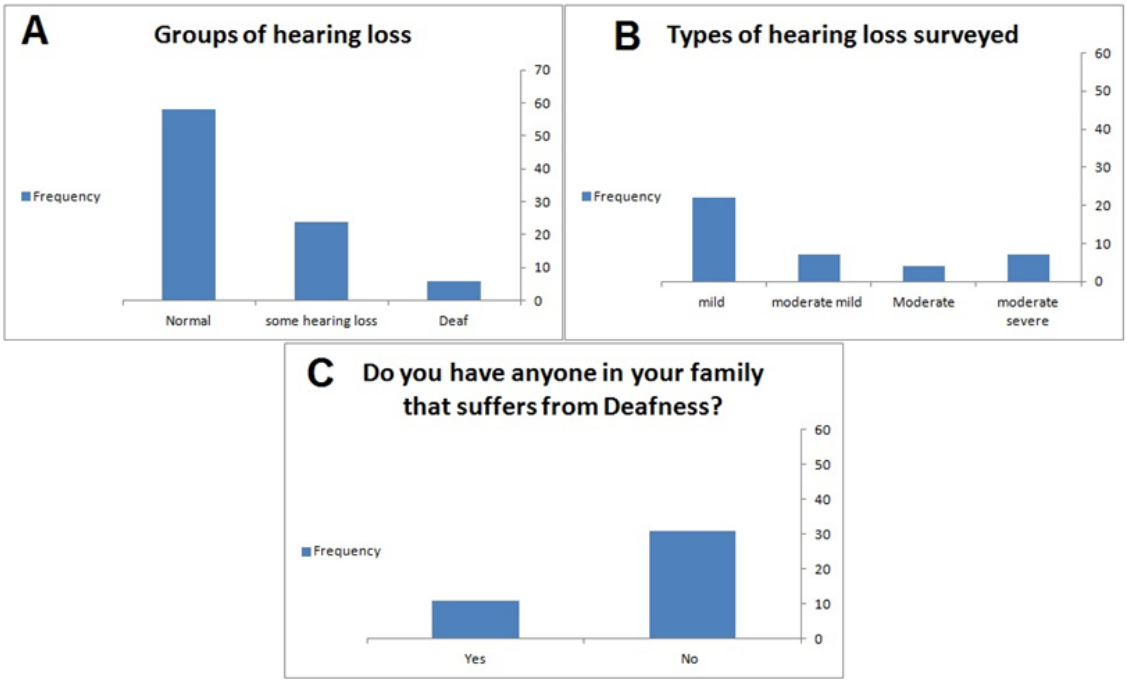


Figure 1. Demographics of hearing loss among the students at the University of Hail. A = $p < 0.05$. B = $p < 0.05$. C = $p < 0.05$. The X axis is for response: yes or no and the Y axis is for frequency

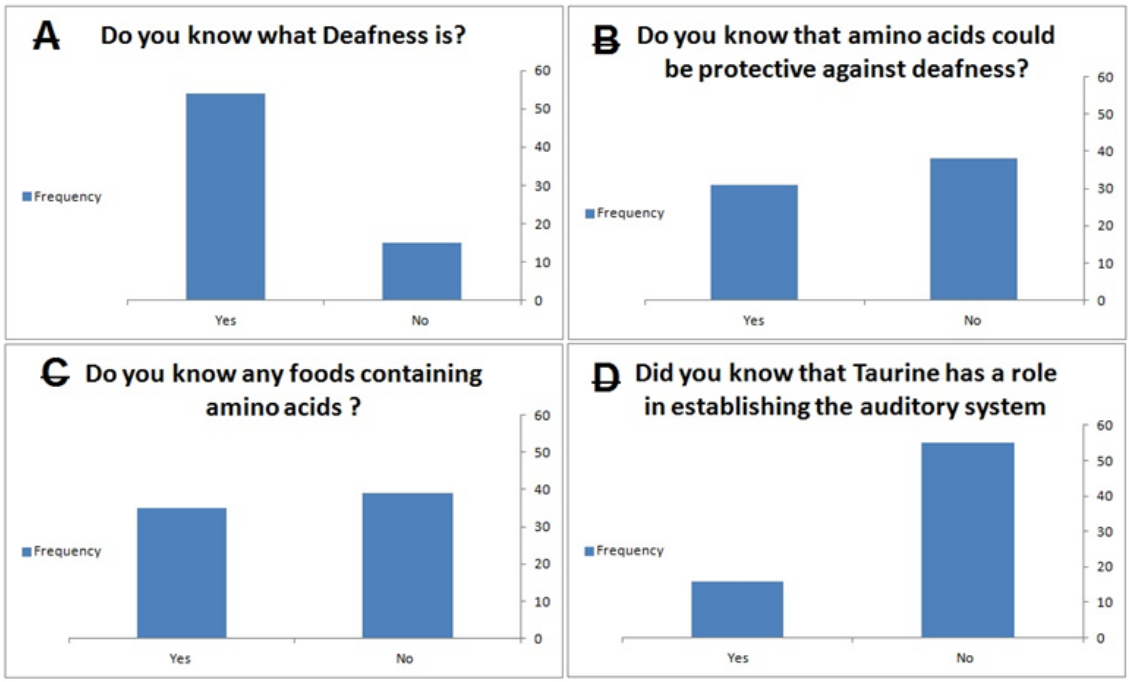


Figure 2. Current knowledge on the relationship between amino acids and deafness among the students at the University of Hail. A = $p < 0.05$. B = $p > 0.05$. C = $p > 0.05$. D = $p < 0.05$. The X axis is for response: yes or no and the Y axis is for frequency

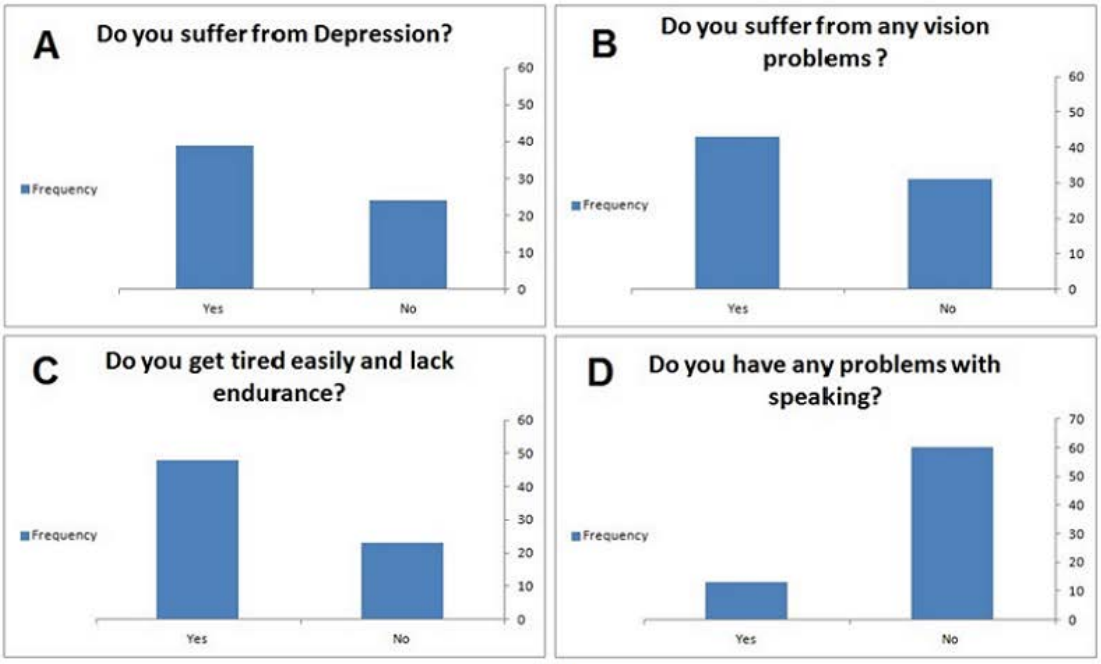
Foods never eaten by the students include sunflower seeds, Brussels sprouts and oats with values of 4.5%, 3.4% and 3.4% respectively.

Most of the students in this study were between the ages of 18 and 19. We surveyed 100 students, but only received 88 completed questionnaires.

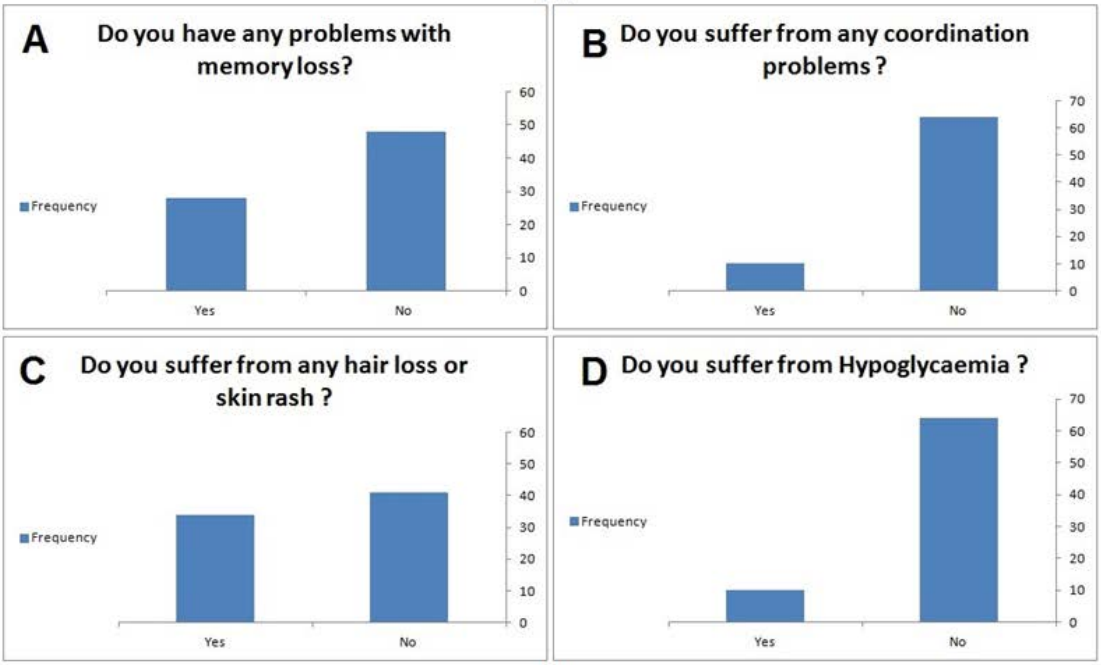
There was a statistically significant difference in the groups of hearing loss among the students (30/88 hard of hearing and 5/88 deaf $p < 0.05$) (Figure 1 A). There was a statistically significant difference among the students in the types of hearing loss (5 Moderate severe, 22 Mild deafness, 7 moderately mild and 4 with moderate hearing loss from 88 $p < 0.05$) (Figure 1 B).There was a statistically significant difference in the presence of family history of deafness among the students (31/88 $p < 0.05$) (Figure 1 C)

A significant number of females understood what deafness was (54/83 = $p < 0.05$) (Figure 2 A) and did not know about the role of Taurine in establishing the auditory system (55/83 $p < 0.05$) (Figure 2 D). There was no significant difference in the responses the questions regarding the knowledge of amino acids and their protection in deafness (Figure 2 B) and if they know any foods containing amino acids ($p > 0.05$) (Figure 2 C)

There was no statistically significant difference between the students who suffer from depression (Methionine deficiency [30] (Figure 3 A a), Vision problems (Figure 3 A b) and endurance problems (Figure 3 A c) (Taurine deficiency [31]). There was a statistical significant difference in the lack of problems with speaking (Glutathione deficiency) [32] among the students (60/83 $p < 0.05$) (Figure 3 A d).



3·A



3·B

Figure 3. A. The effects of amino acid deficiency among the students at the University of Hail. A = $p > 0.05$. B = $p > 0.05$. C= $p > 0.05$. D= $p < 0.05$. The X axis is for response: yes or no and the Y axis is for frequency. **B.** The effects of amino acid deficiency among the students at the University of Hail. A = $p > 0.05$. B = $p < 0.05$. C= $p > 0.05$. D= $p < 0.05$. The X axis is for response: yes or no and the Y axis is for frequency

There was no statistically significant difference between the students who suffer from memory loss (Glutathione deficiency [32] (Figure 3 B a) and hair loss and rash (Figure 3 B c) (Arganine deficiency [33]) ($p > 0.05$). There was a significant difference in the responses of students who did not have coordination problems (Figure 3 B b) and those without Hypoglycemia (carnitine deficiency [34]) (64/83 $p < 0.05$) (Figure 3 B d).

There was a statistically significant difference in the number of students who eat out (60/88 $p < 0.05$) (Figure 4 A). There was a statistically significant difference among the students in terms of the frequency they eat outside the home (21/88 daily, 29/88 once a week, 11/88 two times a week and 11/88 three times a week $p < 0.05$) (Figure 4 B). There was a statistically significant difference between the types of food the students eat out with 57/88 opting for fast food (Figure 4 C) ($p < 0.05$) There was a statistically significant difference in the intake of all types of fast food (33/88 $p < 0.05$) (Figure 4 D).

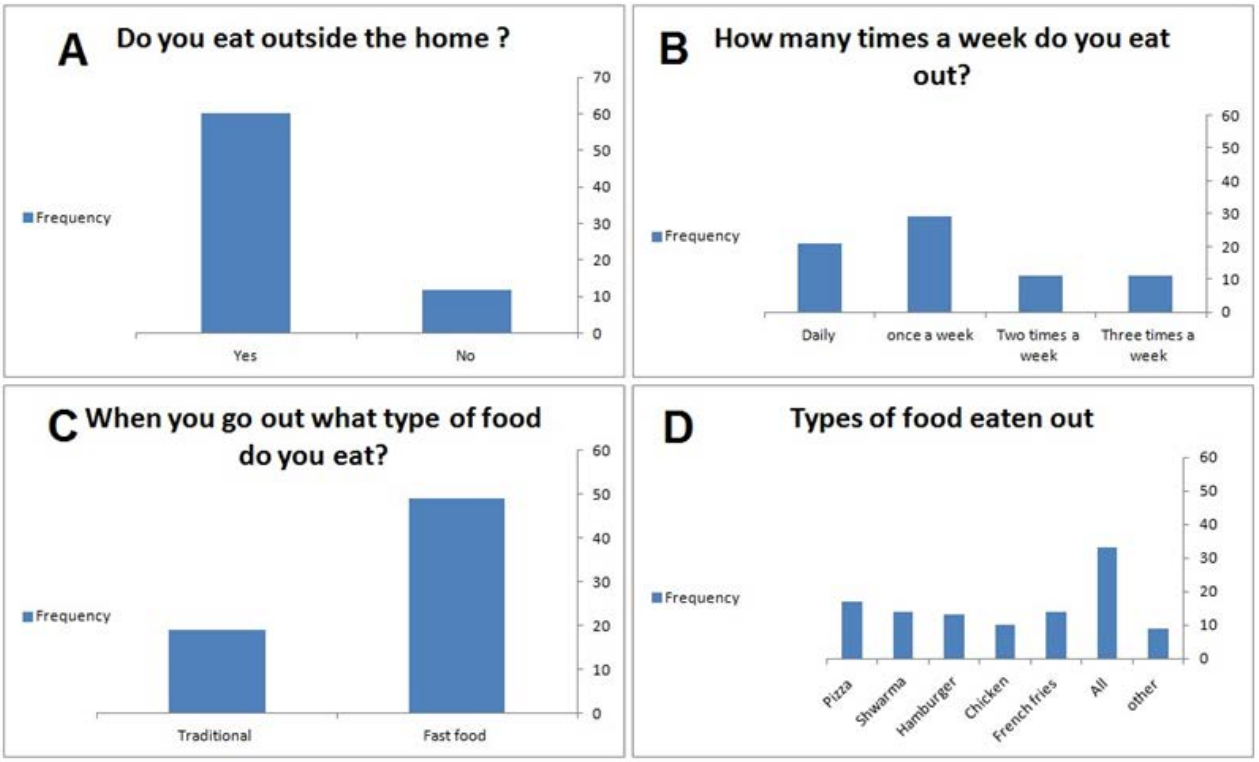


Figure 4. Eating habits among the students at the University of Hail. A = $p < 0.05$. B = $p < 0.05$. C = $p < 0.05$. D = $p < 0.05$. The X axis is for response: yes or no and the Y axis is for frequency

4. Discussion

The present study was addressed to look at the dietary intake of certain amino acids among the students at the University of Hail and their relationship to hearing deficiency.

In recent years, high-energy food snacks have become readily available for the majority of Saudi children and Adolescents.

Two thirds of the students both normal and hard of hearing surveyed in our study, consumed chocolate on a daily basis. Our findings of 61.3% coincide with those from a study in UAE (United Arab Emirates) where the average candy intake more than three times per week among adolescents was found to be 62.9% [35]. Chocolate is a rich source of Arginine [33] and therefore arganine was present in the diets of the students in this study. The students also had no symptoms of Arginine deficiency such as hair loss or skin rash.

Arganine is important in the generation of gap functional junctions in the Inner ear which are large intercellular aqueous pores formed by head-to-head association of two gap-junctional hemichannels (connexin hexamers), one from each of the adjacent cells. The mechano-transduction of sound waves into electrical impulses occurs in the cochlea, which houses the organ of Corti. In particular Connexin 26 the predominant Connexin requires Arginine to function and Arginine cannot be replaced by other residues [36].

Broccoli, Brussels sprouts, oats, granola, wheat germ, sprouted lentils were items not consumed by the students or consumed very rarely. All of these foods are sources of glutathione [32]. The students also exhibited no statistically significant increase in the symptoms of glutathione deficiency such as speech or memory loss. This may be through obtaining the glutathione in an alternative way. Further studies to look at redundant amino acids and their dietary intake could address this.

Dairy and red meat were also eaten during the course of the day by the students three times a day and once a day respectively; both of these are sources of methionine and carnitine. The students also exhibited no symptoms of methionine [30] or carnitine [34] deficiency such as memory loss and hypoglycemia respectively. These amino acids were also therefore adequate in the diet.

Methionine sulfoxide reductases (Msr) catalyze the repair of oxidized methionine in proteins by reducing methionine sulfoxides (Met-SO) to the corresponding methionines, thus preserving the proteins biological

activity after oxidative damage due to reactive oxygen species [37]. D methionine has been shown to protect the activity levels of sodium dismutase, catalase and glutathione reductase from cisplatin-induced decrements [38]. Additionally, methionine has been reported to increase intracellular and mitochondrial glutathione levels [39,40] this control of mitochondrial glutathione levels could take over catalase action in converting peroxide into water, which may play a particularly important role in prevention of noise-induced hearing loss, as noise exposure alters the ratio between reduced and oxidized glutathione in the cochlea [10]. Its protective mode of action depends upon up-regulation of the anti-oxidant pathways. This is important as an increase in reactive oxygen species (ROS), could in turn activate caspases and initiate apoptosis or programmed cell death [41]. Apoptosis plays an essential role in normal development throughout the body, including the inner ear [41]. Mice homozygous for a targeted deletion of caspase 3 display rapid hearing loss and profound deafness by P 30 as a result of the degeneration of inner and outer hair cells and neurons in the spiral ganglion [42].

The student's intake of fish every other day was 21.7%. Fish/seafood are a good source of taurine [31]. The students also exhibited no symptoms of taurine deficiency that were statistically significant such as vision or endurance problems. Taurine has been shown to have a homeostatic role in the inner ear of the guinea pig under particular conditions such as osmoregulatory stress [43].

The overall weekly frequency of fast-food intake in the present study was significantly higher with 32% going out once a week such a frequency is much lower than the average frequency of fast-food intake of 4.5 times per week recently reported for adolescents in Riyadh [44] and higher than the average frequency that was reported for Saudi adolescents in another study [45].

In addition, daily consumption of fast food by adolescents in the present study (23% for females) is not much different than the 30% that was recently reported for adolescents in Abha [46].

The increased intake of fast food in our study equates with high levels of fat, free sugars, sodium, and cholesterol [26,27].

Experimental chronic hypercholesterolemia stresses inner ear tissue metabolically, inducing cochlear glycogen accumulation and edema in both the stria vascularis and outer hair cells [47]. Changes associated with these conditions occur in the Basal cochlear turn and are associated with auditory dysfunction observed in ABR (auditory brainstem responses), in which reduced hearing sensitivity is observed in response to a cholesterol-supplemented diet [48]. Vascular occlusion has also been suggested as a possible mechanism by which hyperlipidemia may contribute to an increased risk of senserineuronal hearing loss pathogenesis. In a clinical case control study of 155 SHL (sensirineuronal hearing loss) patients and 155 controls, a multivariate analysis showed cholesterol levels to be an independent acquired risk factor 4.8 times more likely to be associated with the SHL population than with controls, indirectly supporting the vascular hypothesis [49].

In the present study heredity and family history were responsible for 18% of cases for deafness. This coincides with a study that found heredity to account for 15.5% of cases of deafness [50]. Such genetically-determined deafness may be attributed to the high prevalence of consanguinity among the Saudi population which increases the risk of transmission of both autosomal recessive and the polygenetic (multifactorial) inheritance [51].

5. Conclusions

The Dietary intake of the amino acids linked to deafness is therefore adequate for the students in this study.

The students felt the knowledge of amino acids in deafness would help their families in the long term.

Arginine consumption via chocolate is one of the highest among the students.

The fast food intake among deaf students and non deaf students in this study is significantly high.

Workshops to educate the students and their families on diet and hearing loss would be something for the future.

Acknowledgements

We would like to thank the students for their assistance in this project in answering our questionnaires. We are deeply grateful for the University of Hail for funding this research. All authors declare no conflicts of interest.

Author Contributions

SA wrote most of the paper and was the group leader for this project. AT did the analysis of the results and translation of surveys from Arabic to English and vice versa. BAMA wrote part of the paper and was involved in the collection of data. All authors contributed equally to this work.

Abbreviations

KSA; Kingdom of Saudi Arabia.
BAEP; brain stem auditory evoked potentials.
IAAO; Indicator Amino Acid Oxidation.
FAO/WHO/UNU; World health organization.
UAE; United Arab Emirates.
Msr; Methionine sulfoxide reductases.
Met-SO; methionine sulfoxides.
ROS; reactive oxygen species.
SHL; Sensirineuronal hearing loss.
ABR; auditory brainstem responses.

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Appendix

Surveys

Demographic Information Sheet

Sex: F
How old are you? _____
Graduate degree _____
Marital Status:
Married/Partnered _____
Single, never married _____
Current Living Arrangement:
House _____
Apartment _____
Group Residence ____

Questions related to deafness and amino acids knowledge

Do you know what deafness means?
Yes No
Did you know that certain amino acids in your diet could be protective against deafness?
Yes No
Do you know any foods that contain these amino acids?
Yes No
Did you know that Taurine has a role in establishing your auditory system?
Yes No

Symptoms of amino acid deficiency

Have you ever experienced feelings of depression?
Yes No
Have you ever experienced any vision problems?
Yes No
Do you feel tired a lot and lack endurance?
Yes No
Do you have any problems sometimes with speaking?
Yes No
Do you have any problems with memory loss?
Yes No
Do you have any problems with coordination?
Yes No
Have you ever experienced hair loss or rash on your skin?
Yes No
Do you suffer from Hypoglycemia?
Yes No

Questions related to deafness

Do you consider yourself deaf or hard of hearing?
_____ Deaf
_____ Hard of Hearing
Is your degree of Hearing Loss?
_____ Mild
_____ Mild-Moderate
_____ Moderate
_____ Moderate-Severe
_____ Profound
Did you experience deafness or hearing loss?
_____ Before age three?
_____ During adolescence?
_____ During young adulthood (e.g., 20-35)
Age at onset of deafness/hearing impairment: _____
How many years have you been deaf/hard of hearing?
Besides being deaf/hearing impaired, are there any other medical/physical disabilities that you are aware of that you have?
___ Yes (Please indicate)
_____
_____
_____
_____ ___ No
How many people are in your family? _____
Are any of them hard of hearing? Yes No
Do you eat outside the home?
Yes
No
How many times do you eat outside the home?
Daily
Once a week
Twice a week
Three times a week
Types of food you depend on?
Homemade
Restaurant
In the restaurant what type food do you eat?
Traditional
Fast food
Type of fast food always taken:
Pizza
Shawarma
Hamburger
Fried Chicken
French fries
All of the above
Other