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Original Research Article

Phenotypic Variations of Ear Lobule among Students in Jeddah, Saudi Arabia

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Abstract

The study was conducted to determine the prevalence of the ear lobule phenotypic variations being free or attached between Saudi students in Jeddah. The association of each type with tongue rolling ability, blood group; A, B, O, AB and the presence of either type of ear lobule pattern in the family generation; first, second and third generations. A Questionnaire was designed to collect data required for the research. It included personal information, family history, ear lobule pattern and also measurement of the upper and lower level of ear auricle. The students were selected on the basis of cluster random Sample technique. The questionnaire was distributed among 121 students.105 (86.7%) of students from medical and paramedical colleges and 16 (13.2%) from secondary school. The results revealed (82.6%) had free ear lobule, while (17.4%) had attached ear lobule. It was observed that the majority of students had free ear lobule, (60%) students had ability to roll the tongue, (46.3%) had blood group O, (76.9%) had oval shaped ear and (76.5%) had their pinna in true anatomical location. It thus appeared that the inheritance of ear lobe pattern is independent of other phenotypic variables. Regarding to the inheritance of trait from parents, 92% of students with free ear lobule have their mothers with the same phenotype while the fathers of (93%) students with free ear lobule had the same ear lobule phenotype. In case of students having attached ear lobule the percentage of this trait was similar in both fathers and mothers. The present study indicated that the inheritance of ear lobule pattern is independent of other phenotypic variables also it have a significant concern in clinical field as it can provide an idea about the blood group in relation to the different ear lobule pattern.

Keywords: Ear Lobule, Phenotypic Variations, Random Sample, Students

INTRODUCTION

The ear is the organ that detects or act as a receiver for sound; it also plays a major role in the sense of balance and body position. The pinna (auricle) is the first step in hearing, placed symmetrically on opposite sides of the face. This arrangement aids in the ability to localize sound sources. The ear lobule is the last part of the auricle to develop (Standring et al., 2005). Somatoscopic features of the external ear such as shape, form, ear lobe attachment to the cheek can act as soft biometric traits. Soft biometric traits are those characteristics that provide some information about an individual, but lack the distinctiveness and permanence to sufficiently differentiate between individuals (Jain et al., 2000). This information is of great importance not only to physical anthropologists but also to plastic surgeons and physicians (Singh and Purkait, 2009).

Lobule parameters are important for plastic surgeons who aim to achieve a proper balance between right and left earlobes in reconstruction surgeries (Sharma et al., 2007). However an ear pattern is not a simple one and is

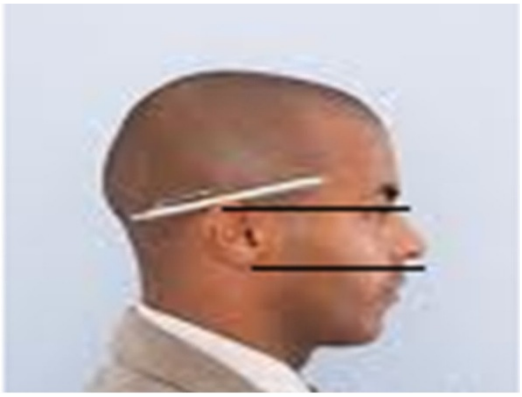

Figure 1. Measuring the upper and lower level of ear auricle

characterized by a complex distribution of various features (Purkait and Singh, 2008).Determination of ear position helps physicians in detecting anomalies such as Down's syndrome and other disorders (Singh and Purkait, 2009). In fact, population diversity provides a unique opportunity to study the morphogenetic variation among the endogamous populations living in different geographical and ecological conditions (Bhasin and Khanna, 1994).

The phenotype in human being refers to the actual observed properties, such as morphology, development, or behavior. These properties can be easily observed and measured. It usually expresses an underlying genetic variation.Postnatal abnormalities in ear dimensions and position are common findings in several alterations of the human chromosomes and karyotype, and in developmental defects of the first and second branchial arches (Hunter and Yotsuyanagi, 2005 and Stark et al., 2008).

Some scientists have reported that this trait is due to a single gene for which unattached earlobes is dominant and an attached earlobe is recessive. Other scientists have reported that this trait is probably due to several genes. The size and appearance of the lobes are also inherited traits (Stark et al., 2008 and Arnold, 2009).

The aim of the present was to study prevalence of ear lobe pattern whether attached or free among students in Jeddah, and to assess the possible relation with the ability to roll the tongue, blood groups and the presence of such trait in the family.

MATERIAL AND METHODS

Sample Selection

The Study included 121 female students (18-25 years) from medical colleges in King Abdul-Aziz University and secondary school (Scientific Section) in Jeddah. The students were selected on the basis of cluster random Sample technique. The sample was chosen to include students who studied genetics among subject of basic sciences. This sample included 65 students from the medical college; 45 in the sixth year and 20 in the second year. 30 students participated from second year pharmacy. Only 10 students participated from second year dentistry. From the third secondary grade in high school only 16 students participated.

A questionnaire was designed to assess the prevalence of ear lobe pattern (attached versus unattached) between students, and its association with the blood groups, the ability to roll tongue and presence of such trait among their families. The questionnaire was distributed after the approval of Ethical Committee in King Abdul-Aziz University.

Data Collection: The questionnaires were constructed of four main sections; under each section were various subdivisions. The main sections included personal data, family data, ear lobule Pattern and ear measurement. The Personal data included information about age, weight, height, skin, blood group and nationality. Family data include information about family lineage (grandparents) of parents, hearing problems, ear lobule pattern description of free or attached ear lobule, shape of auricle and presence or absence of attached ear lobule in family members. (Carey et al, 2006).

The questionnaires were written in Arabic (mother tongue of students). The students, among whom the questionnaires were distributed, were allowed to take it home for their parent's approval and to fill in the data related to their families. At the time of the collection of questionnaires the measurements of upper and lower levels of the ear pinna were taken using a ruler according to Carey et al (2006). (Figure 1).

Data Analysis and Statistics

All the results were tabulated and statistically analyzed using statistical package of social sciences (SPSS)

Table 1. Showing the frequency of the students according to the grade

Grade	Frequency	Percent
2 Medicine	20	16.5%
6 Medicine	45	37.2%
2 Pharmaceuticals	30	24.8%
2 Dentistry	10	8.3%
3 High school	16	13.2%
Total	121	100.0%

Table 2. Showing the frequency of the students according to the ear lobule.

Ear lobule	Frequency	Percent
Free	100	82.6%
Attached	21	17.4%
Total	121	100.0%

Table 3. Showing the frequency of the students according to the blood group.

Blood group		Frequency	Percent
Valid	O	56	46.3
	AB	7	5.8
	B	23	19.0
	A	34	28.1
	Total	120	99.2
Missing	System	1	.8
Total		121	100.0

Table 4. Showing the frequency of the students according to the shape of auricle.

Shape of auricle	Frequency	Percent
Round	18	14.9
Oval	93	76.9
Triangular	10	8.3
Total	121	100.0

program version 16 (2007) to assess the extent of variation in ear lobule pattern and obtained the frequencies, percentage and the relationship between the values. The CHI-Square test was used to determine significance variations between the data.

The data were compared with other population groups reviewed in available literature.

RESULTS

Thisstudy was designed to estimate the phenotypic variations of ear lobule pattern among secondary school students, as well as medical students.One hundred and twenty one students answered the questionnaire, 45 students (37.2%) from 6th year medicine, 20 students (16.5%) from 2nd year medicine, 30students (24.8%) from 2nd year Pharmacy, 10 students (8.3%) from 2nd year Dentistry and 16 students (13.2%) from 3rd year secondary school (Table 1). In this study 100 students (82.6%) had free ear lobule, while 21 students (17.4%) had attached ear lobule (Table 2).

Regarding the prevalence of the difference blood groups, 56 students (46.3%) had blood group O, 34 students (28.1%) had blood group A, 23 students (19%) had blood group B and only 7 students (5.8%) had blood group AB (Table 3). The oval shaped auricle was noticed in most of the students as 93 students (76.9%) had oval shaped auricle, while 18students (14.9%) had rounded shape auricle and only 10 students (8.3%) had triangular shaped auricle (Table 4).

Regarding the familial hearing proplems accompanging the different ear lobule pattern it was found that in case of free lobule pattern 13 students

Table 5. Showing the relationship between ear lobule patterns and hearing problems.

Ear lobule * Hearing problems Cross-tabulation						
		Hearing problems				
Ear lobule *Hearing problems		First generation father, mother, sister or brother	Second generation (granddad or grandma)	Third Generation (Aunt or Uncle)	Non	Total
Ear lobule	Free	13	1	3	83	100
	Attached	3	0	1	17	21
	Total	16	1	4	100	121

Table 6. Showing the relationship between ear lobule pattern and shape of the auricle.

Ear lobule * Shape of auricle Cross-tabulation						
			shape of auricle			
			Round	**Oval**	**Triangular**	**Total**
Ear lobule	Free	Count	12	80	8	100
		% within Ear lobule	12.0%	80.0%	8.0%	100.0%
	Attached	Count	6	13	2	21
		% within Ear lobule	28.6%	61.9%	9.5%	100.0%
	Total	Count	18	93	10	121
		% within Ear lobule	14.9%	76.8%	8.3%	100.0%

Table 7. Showing the relationship between ear lobule pattern and ability to roll the tongue.

Ear lobule * Ability to roll the tongue Cross-tabulation			
	Ability to roll the tongue		
Ear lobule	Yes	No	Total
Free	62	38	100
Attached	11	10	21
Total	73	48	121

(13%) had hearing problems in relatives of the first generation, one student (1%) had it in second generation and 3students (3%) had a family history of hearing problems in third generation. 83 students (83%) didn't have any family history. In case of attached lobule pattern(21 students), 3students (14.2%)had hearing problems in first generation, none in second generation and one student (4.7%) had a family history of hearing problems in third generation. 17students (80.9%) didn't have any hearing problems among their relatives (Table 5).

Regarding the relationship of ear lobule pattern with the different shapes of the auricle, it has been found that in cases having free ear lobule, 80 students (80%) had free lobule with oval shaped auricle, 12students (12%) with rounded shape auricle and 8(8%) with triangular shaped auricle. In case of students having attached ear lobule, 13 students (61.9%) had oval shaped auricle, 6 students (286%) had round shaped auricle and 2(9.5%) with triangular shaped auricle (Table 6).

The ability to roll the tongue was evident in 62 students (62%) with free ear lobule, 38 students (38%) didn't have such ability. 11 students (52.3%) having attached ear lobule had the ability to roll the tongue, while 10 students (47.6%) lacked this ability (Table 7).

In a trial to relate the different blood groups to those having the ability to roll the tongue in different ear lobule pattern, it was found that 31 students (50.0%) with free lobule and ability to roll the tongue had blood group O, while 17(27.4%) had blood group A, 11(17.7%) had blood group B and only 3 students (4.8%) had blood group AB. In cases of students having attached ear lobule, 7 students (63.6%) with attached lobule and ability to roll the tongue had blood group O, while 2(18.2%) had blood group A. 2 students (18.2%) had blood group B and no students had blood group AB. 15 students (40.5%) with free lobule and lacked the ability to roll the tongue had blood group O. 14(37.8%) had blood group A, 5(13.5%) had blood group B and only 3 students (8.1%) had blood group AB. In case of students having attached ear lobule, 3 students (30%) with attached lobule and couldn't roll the tongue had blood group O, while 1 student(10%) had blood group A, 5 students(50%) had blood group B and only one student (10%) had blood group AB (Table 8).

Table 8. Showing the relationship between ear lobule pattern, ability to roll the tongue and blood group.

Ear lobule * Blood group * Ability to roll the tongue Cross-tabulation								
Ability to roll the tongue				**Blood group**				
				O	**AB**	**B**	**A**	**Total**
Yes	Ear lobule	Free	Count	31	3	11	17	62
			% within Ear lobule	50.0%	4.8%	17.7%	27.4%	100.0%
		Attached	Count	7	0	2	2	11
			% within Ear lobule	63.6%	.0%	18.2%	18.2%	100.0%
		Total	Count	38	3	13	19	73
			% within Ear lobule	52.1%	4.1%	17.8%	26.0%	100.0%
No	Ear lobule	Free	Count	15	3	5	14	37
			% within Ear lobule	40.5%	8.1%	13.5%	37.8%	100.0%
		Attached	Count	3	1	5	1	10
			% within Ear lobule	30.0%	10.0%	50.0%	10.0%	100.0%
		Total	Count	18	4	10	15	47
			% within Ear lobule	38.3%	8.5%	21.3%	31.9%	100.0%

Table 9. Showing the relationship between ear lobule pattern in students and their parents.

Student ear lobule * Mother ear lobule					
			Mother ear lobule		
		Ear lobule * Mother ear lobule	Free	Attached	Total
Ear lobule	Free	Count	92	8	100
		% within Ear lobule	92.0%	8.0%	100.0%
		% within Mother ear lobule	92.0%	38.1%	82.6%
	Attached	Count	8	13	21
		% within Ear lobule	38.1%	61.9%	100.0%
		% within Mother ear lobule	8.0%	61.9%	17.4%
	Total	Count	100	21	121
		% within Ear lobule	82.6%	17.4%	100.0%
		% within Mother ear lobule	100.0%	100.0%	100.0%

Student ear lobule * Father ear lobule					
			Father ear lobule		
			Free	Attached	Total
Ear lobule	Free	Count	93	7	100
		% within Ear lobule	93.0%	7.0%	100.0%
		% within Father ear lobule	92.1%	35.0%	82.6%
	Attached	Count	8	13	21
		% within Ear lobule	38.1%	61.9%	100.0%
		% within Father ear lobule	7.9%	65.0%	17.4%
	Total	Count	101	20	121
		% within Ear lobule	83.5%	16.5%	100.0%
		% within Father ear lobule	100.0%	100.0%	100.0%

Regarding to the inheritance of trait from parents, 92students (92%) were similar to their mothers in having the free ear lobule trait, while in 8 students (8%) the mothers had attached ear lobule. 93 students (93%) were similar to their fathers in having the free ear lobule trait, while in 7 students (7%) the fathers had attached ear lobule. It thus appears that inheritance of such trait free ear lobule for fathers and mothers were almost similar. In case of students having attached ear lobule, 13 students (61.9%) had either of their parents with the attached ear lobule pattern while 8 students (38.1%) had neither of their parents with attached ear lobule. The percentage was similar in both fathers and mothers. (Table 9).

The positions of upper and lower edges of the ear auricle were assessed in relation to the tail of eyebrow and upper lip respectively. In cases of free ear lobule pattern, it was found that normally located auricle appendage were present in 39 students (76.5%), while only 5 students (83.3%) in case attached ear lobule pattern. The upper level of the auricle varied in both free and attached ear lobule pattern. In cases of free ear lobule pattern 6 student (11.8%) had the upper level lower by (1cm), while in 3 students (5.9%) it was lower by 0 .5 cm, where as in 3 students (5.9%) the upper level

Table 10. Showing the relationship between ear lobule pattern and level of the edges.

Ear lobule * Level of the upper edge * Level of the lower edge Cross-tabulation								
Level of the lower edge				Level of the upper edge				
				at same level	- 1 cm	-,5 cm	+ 1cm	Total
at same level	Ear lobule	Free	Count	39	6	3	3	51
			% within Ear lobule	76.5%	11.8%	5.9%	5.9%	100.0%
		Attached	Count	5	1	0	0	6
			% within Ear lobule	83.3%	16.7%	.0%	.0%	100.0%
		Total	Count	44	7	3	3	57
			% within Ear lobule	77.2%	12.3%	5.3%	5.3%	100.0%
between lip and nose	Ear lobule	Free	Count	34	9	4		47
			% within Ear lobule	72.3%	19.1%	8.5%		100.0%
		Attached	Count	13	1	1		15
			% within Ear lobule	86.7%	6.7%	6.7%		100.0%
		Total	Count	47	10	5		62
			% within Ear lobule	75.8%	16.1%	8.1%		100.0%
lower lip	Ear lobule	Free	Count	1	1			2
			% within Ear lobule	50.0%	50.0%			100.0%
		Total	Count	1	1			2
			% within Ear lobule	50.0%	50.0%			100.0%

was higher by1cm. In cases of attached ear lobule pattern, only one student (16.7%) had the lower level raised by (1cm).

The lower level of the auricle varied in both free and attached ear lobule pattern. In cases of free ear lobule pattern 56 students (56%) had the lower level at the nasolabial area while in 2 students (2%) it was low and reached the lower lip. In cases of attached ear lobule pattern, only 15 students (23.8%) had the lower level at the nasolabial area (Table 10).

DISCUSSION

The term 'genotype' is generally used to refer to the genetic make-up or constitution of an individual organism, be it virus, fruit fly or human. In contrast, we use the word 'phenotype' to cover the form and functioning of an individual, to the extent that it may encompass metabolism and behavior (and thus we can refer to 'behavioral phenotypes). Clearly, the phenotype, be it adult or embryonic, is always the product of the combined effects of genetic and environmental influences (Sykes, 1993), but the relative contributions of each can differ for each aspect of the phenotype.

Studying phenotypic variation especially somatoscopic features was the centre of interest of many researchers. It acts as soft biometric traits that improve the performance of the primary biometric system of personal identification. It also aids the surgeons while reconstructing deformed parts and also helps physicians in detecting anomalies.In the present study most of the students had free ear lobule which constituted about (82.6%). Singh and Purkait, (2009) in their study on 700 individuals of both sexes in the central region of India also found that free ear lobule pattern (62%) exceeded that of the attached pattern (19.14%). Similarly, Bhowmik (1971) stated that, free ear lobes were found to be more frequent among the Brahmin (77.5%) and the Muslim males (78.4%) in India.

Regarding to the inheritance of trait from parents, 92% of students with free ear lobule have their mothers with the same phenotype while the fathers of (93%) students with free ear lobule had the same ear lobule phenotype .In case of students having attached ear lobule the percentage of this trait was similar in both fathers and mothers. There was statistically significant relationship between the ear lobule pattern of the students and that of their parents, depending on the laws of genetics (Hunter and Yotsuyanagi, 2005 and Stark et al., 2008).

Twenty one students (17.4%) in the present study had attached ear lobule. This percentage was quite low as compared to study done by Lai and Walash (1966) in which the frequency of attached ear lobule among Japanese subjects were 67.1% and in Chinese subjects it is 64.3%, which was also quite high as compared to 35.1% in Indian subjects.

In the present work, (50.0%) of the students having free ear lobule and ability to roll the tongue had blood group O, while (63.6%) of the students having attached ear lobule and ability to roll the tongue had blood group O. 40.5% of the students having free ear lobule and didn't have the ability to roll the tongue had blood group O. On the contrary Nwaopara et al, (2009) in their study found that only (5.6%) of the total studied cases (193) had free ear lobule, ability to roll the tongue and blood group O, while (10.36%) had free ear lobule, blood group O and did not have ability to roll their tongues.

In this study there was no significant relationship between position of upper and lower edges of the ear

auricle in relation to the tail of eyebrow and upper lip respectively. 76.5% of the students had common located ear auricle as regarding the upper and lower edges. Singh and Purkait, (2009) found that the upper edge of the auricle was most commonly located at the level of the eyebrow tail which was in agreement with the present study while its lower edge was raised than the level of the upper lip to reach the nasolabial area, which was not in accordance with the present work.

CONCLUSION

The present study indicated that the inheritance of ear lobule pattern is independent of other phenotypic variables also it have a significant concern in clinical field as it can provide an idea about the blood group in relation to the different ear lobule pattern. It is recommended that more studies should be done on a wider scale to ensure the validity and reliability of the present results and to detect any other related trait to the ear lobule

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