The Primary Hypolactasia Frequency in 7-12-Year-old Albanian Pupils in F.Y.R.O.Macedonia

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Abstracts - Through this research, the frequency of the primary hypolactasia phenotype has been determined and it includes the Albanian pupils in Macedonia from 7 to 12 years of age, as a result of the existence of the Lac_R allele. The correlation between the lactose maldigestion prevalence and the ageadvancement changes has also been analyzed. The research included 115 primar school children in Macedonia at the age of 7 to 12 years of Albanian nationality. The glucose level in them was measured before and 40 minutes after the input of 200 – 220 ml of milk on an empty stomach, or 2 grams of lactose per one kilogram body weight. The emergence of clinical signs, such as glucose level increases with less than 1.1 mmol/l\L, stomachaches, belly bulge, diarrhea, etc., have been considered as determining parameters of the existence of primary hypolactasia and Lac_R allele in the persons in question. The result is that the average of the primary hypolactasia phenotype in the Albanian population sample in Macedonia which underwent the analysis has been represented in 71.22% of the cases.

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I. INTRODUCTION

Lactose intolerance is the inability to *metabolize lactose,* because of a lack of the required enzyme lactase in the digestive system.[8] All healthy children from three to five years of age possess a considerable amount of the lactase ferment in their digestive tract. Lactase hydrolizes the glycosidic linkages β1, 4 that exist between the glucose and lactose with in the composition of lactose as disaccharide. With the growth of the person, there are changes occurring in terms of the activity of this enzyme. This phenomenon is known as primary hypolactasia and is present in different ethnic communities with a varying frequencies. These persons are considered to be intolerant towards lactose – IL. It is estimated that 75% of adults worldwide show some decrease in lactase activity during adulthood.[8] The frequency of decreased lactase activity ranges from as little as 5% in northern Europe, up to 71% for Sicily, to more than 90% in some African and Asian countries.[4]

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Primary hypolactasia is inherited as a recessive autosomic feature. The prevailing allele which determines the tolerance against lactose is known as Lac_P (lactase persistence), whereas the restrictive one as Lac_R (lactase restriction)[1]. Clinical manifestation of lactose intolerance is, generally speaking, most variable and depends, not only on the severity of enzymic deficit and on the degree of its overload, but on the patient's age and compensatory capacity of the colon as well. [2, 3, 10, 12, 13, 14]

II. OBJECTIVE

The main objective of this research was to find the dispersion frequency of the primary hypolactasia phenotype in Albanian pupils in Macedonia of an age from 7 to 12 years old. This would provide a clear picture about the allele Lac_R frequency within the same population. The correlation between the phenotype dispersion and the age of the individuals has also been analyzed.

III. METHOD

115 pupils of Albanian nationality took place in this research. Their age ranged from 7 to 12 years old. The utilized test for the determination of the primary hypolactasia as a phenotype of the Lac_R allele is the one that measures the level of glucose in blood and is known as MTT (milk tolerance test). The glucose measurement has been carried out with a glucose-meter before and 40 minutes after the provision of 200-220 ml of highly adopted cow's milk or 2 grams of lactose per each kilogram of body's weight. The increase in the level of glucose of 1.1 mmol/l is considered as a sign that the person in question suffers from primary hypolactasia. Other symptoms, such as stomachaches, belly bulge, diarrhea, etc. helped us identify those with hypolactasia.

Pupils with general poor health or gastrointestinal illnesses as well as those with family histories of illnesses of gastrointestinal or genetic character were excluded from the research.

The data were processed and grouped in that way to determine the primary hypolactasia dispersion frequency along with the Lac_R allele. The correlation coefficient between the primary hypolactasia phenotype

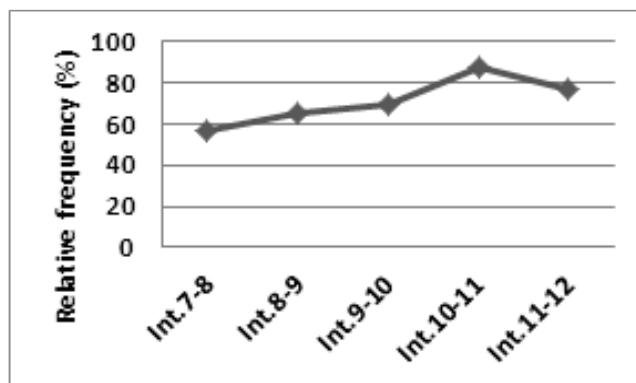dispersion and the age of the individuals has also been reckoned.

IV. RESULTS

115 pupils were divided into 5 classes according to their age, with one year interval difference.

Initial sample data: interval mean $x_{mi\,(vj)}$ of the respective age-group, number of pupils in class-N_i-, numeric frequency of pupils with IL –$y_{oi(num.)}$- and the observed relative frequency in % –y_{oi}-(%), for y_{oi} (%) referring to values of x_{mi} (years) as well as for the increasing linear function have been given in Table 1 also.

Table 1. Initial sample data according to the tendency of the increase of relative frequency of pupils with IL from class to class. The flow of the observed relative frequency of pupils with IL from class to class has been illustrated in the picture below.

Xmi (vj)	Ni	$y_{oi\,(num.)}$	Yoi (%)	Class 1-5 (Ladas)	
Interval mean of the class members' age	Number of pupils in class	Numberic frequency of pupils with IL	Observed relative frequency of pupils with IL in class	Linear line reg. equation	correlation and their significance
7.5	23	13	56.5	y=6.39x+10.50	y=6.49x7.30
8.5	23	15	65.2		
9.5	23	16	69.6	r=0.86	r=0.88
10.5	24	21	87.5		
11.5	22	17	77.3	0.025<p<0.050	p=0.004
Total	115	82			

Fig. 1. The polygonal line of the observed relative frequency of pupils with primary hypolactasia in the initial sample.

a) *The variation of frequency in pupils with IL according to their age, in the interval from 7 to 12.*

In Table 1 we can see the data for y_{oi} (%) referring to values of x_{mi} (years), of the group-age interval means within the respective grades, from 1 to 5, that have been included in the work sample, with a

$$Y_e = 6.39x + 10.50 \qquad (1)$$

tendency of frequency increase of the IL, as well as the acquired results according to an increasing linear function. By using the method of least squares, the equation of the linear regression line for the age interval 7-12 has been determined and it is as follows:

$$Y_e = 6.49x - 7.30 \qquad (2)$$

along with the correlation coefficient between the variables r = 0,86. The level of significance 0.05>p>0.025 has been determined from the formulas and respective statistical charts of critical values for the correlation coefficients, mentioned in the references. [4, 6, 10]

As a reference point the values given by Ladas [8] have also been given for the analog equation:

as well as values r = 0,88 and p= 0,004.

In Fig.2 we can see the position of sample point dispersion (x$_{mi}$, y$_{oi}$) extracted from Table 1, including the respective joining line – the so called polygonal line of frequencies and the position of lines (1) and (2).
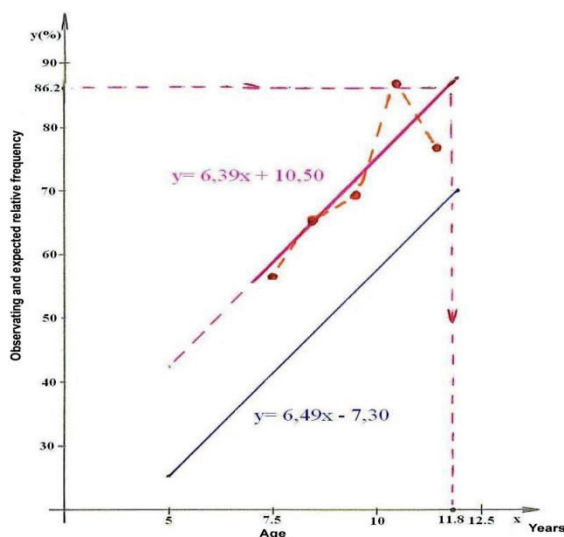

Fig. 2. Polygonal line of frequencies; linear regression lines: according to our sample and according to Ladas.

We can see that within the 7-12 years of age interval, the data expected from our model (1) are approximately 17% higher from those in equation (2).

V. Discussion

From the data in Table 1 and Figure 1 we can conclude that the observed relative frequency of pupils with primary hypolactasia –y$_{oi}$-(%) in classes from 1 to 5 has an increasing tendency.

Having previously processed the data from the initial sample, we can see that the average of the primary hypolactasia phenotype and the Lac$_r$ allele in the Albanian population sample in Macedonia that underwent the analysis is 71.22%. Having into consideration the fact people coming from the same ethnic background, regardless of their distance of residence, are characterized by the same primary hypolactasia prevalence, we can assume that the Albanians living in Albania or Kosovo will most probably have an approximate frequency. However, it has to be verified with further studies.

The quite broad variation of the intolerance prevalence against lactose has led into the assumption that the lactose deficiency is a normal or natural state, whereas the persistence of the significant activity of the lactase in Northern European populations represents an

"abnormal" mutation, which, as it seems, has created an advantage to those that use milk and other dairy products. It is not clear even today whether the usage of milk and dairy products has led to the maintenance of the lactasic activity or the persistence of the lactasic activity itself has helped in the inclusion of dairy products in people's everyday diet.[1]

Today, the allele that determines the intolerance towards lactose and is original and restrictive is Lac$_R$ -(a), whereas the persistence allele is considered to be a dominant mutation –Lac$_P$-(A). By considering the population in equilibrium (a characteristic of civilized populations) and by using the Hardy – Wainberg equation, we have calculated the allele frequencies as shown below:

P^{2}Lac$_P$ Lac$_P$ + 2pq Lac$_P$ Lac$_R$ + q^{2}Lac$_R$ Lac$_R$;

q^{2}Lac $_R$Lac$_R$ =82/115=0,713; qLac$_R$ = 0,844

whereas pLac$_P$ = 0,156;

We have gained the assumed values of the presence of the allele Lac$_R$ from the values of the presence of the primary hypolactasia phenotype, and we can conclude in advance that the Albanian population in Macedonia can be put in the group of those populations where the lactose intolerance prevails: Lac$_R$> 0.84, which means it belongs in the

same group with population from Central Africa, Australia, Malaysia, and Southwestern Asia, based on the classification provided by Danil L. Swagerty. [6]

VI. CONCLUSION

After the procession and analysis of the data from the research on IL that included 115 pupils aged between 7 and 12 from the Albanian population living in Macedonia, characterized as a zone with increasing frequencies, we have come to the conclusion that among the interest variables (the relative frequency of pupils with IL $-y_o$% and pupils' age $-x$-years), there is a positive correlation of r = 0.86, with a level of significance $0.0025 < p < 0.05$.

The model of best approximation of sample points with a tendency to increase, which expresses the relative frequency dependency $-y_e$ (%) expected in pupils with IL, from the age of $-x$ (years), and within the interval of 7 – 12 years of age, is given with the equation of the linear regression line: $y_e = 6.4x + 10.50$.

We can conclude that the relative frequency of primary hypolactasia in children agred between 7 and 12 in the Albanian population in Macedonia is 71.22% which means it belongs in the same group with population from Central Africa, Australia, Malaysia, and Southwestern Asia, based on the classification provided by Danil L. Swagerty [6] and has an increasing tendency with the ageing process itself.

REFERENCES RÉFÉRENCES REFERENCIAS

1) A.I.Kozlov,E.V.Balanovskanj,S.D.Nurbaev, O.P.Balanovski (1998), Genografski podatoci za hipolaktazijata vo Starosvetskata popullacija, Genetika,1998,tom.34,N.4,c. 551-561
2) Amarican Academy of Pediatrics, Committee on Nutrition.(2006)Lactose intolerance in infants, children, and adolescents. Pediatrics. 2006; 118:1279-86.
3) Bhatnagar S, Aggarwal R.(2007)Lactose intolerance. Br Med J.2007;334:1331-2.
4) Bulhões, A.C.; Goldani, H.A.S.; Oliveira, F.S.; Matte, U.S.; Mazzuca, R.B.; Silveira, T.R. (2007). "Correlation between lactose absorption and the C/T-13910 and G/A-22018 mutations of the lactase-phlorizin hydrolase (LCT) gene in adult-type hypolactasia". Brazilian Journal of Medical and Biological Research 40 (11): 1441–6. doi:10.1590/S0100-879X2007001100004. PMID 17934640.
5) Crawshaw I; Chambers I. A concise course in Advaced Level Statistics. Nelson Thornes Ltd. U.K.
6) Danil L. Swagerty; Anne D. Walline etc (2002). Lactose intolerance. University of Kansas. School of Medicine, Kansas City, Kansas. American family Phisician
7) Fowler I; et al. Practical Statistics for Nursing and Health Care (2002).Jon Wiley and sons, LTD, England.
8) "Improved lactose digestion and intolerance among African-American adolescent girls fed a dairy-rich diet (2000)." Journal of the American DieteticAssociation.http://www.accessmylibrary.com/coms2/summary_0286-27939567_ITM.
9) Ladas SD; et al. (1991) Lactose maldigestion and milk intolerance in healthy Greek schoolchildren. The American journal of Clinical Nutrition, Vol.53,
10) Labayen I, Forga L, Gonzalez A, Lenoir-Wijnkoop R, Nutr R. . (2001) Relationship between digestion, gastrointestinal transit time and symptoms in lactose malabsorbers after dairy consumption. Aliment Pharmacol Ther. 2001; 15:543-9.
11) Koni M. (2005) Biostatistika Tirana.
12) Suarez FL, Savaiano D, Arbisi P, Levitt MD. (1997)Tolerance to the daily ingestion of two cups of milk by individuals claming lactose intolerance. Am J Clin Nutr.; 65:1502-6.
13) Tuula VH, Marteau P, Korpela R. (2000) Lactose intolerance. J Am Coll Nutr.; 19:165-75.
14) Walker-Smith JA. (1997) Lactose intolerance. In: Gracey M, Walker-Smith JA, editors. Diarrheal Disease. Philadelphia: Lippincott-Raven Publ;p. 171-89