

DETERMINING THE EFFECT OF CONSUMING FERMENTED MILK DRINKS ON THE INCIDENCE OF CONSTIPATION, DIARRHOEA AND RESISTANCE TO RESPIRATORY ILLNESS

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ABSTRACT

Background. At present, there are many types of milk fermented drinks/beverages on the market that often contain added probiotic microflora. Numerous studies indicate that such products are frequently consumed by adolescents. Within this group, symptoms of respiratory illness feature prominently as well as various and frequent disorders of the gastro-intestinal system that give rise to either constipation or diarrhoea.

Objectives. To determine the effect of consuming fermented milk drinks on the immune systems in teenagers aged 13-16 years through analysing their intakes in relation to how often respiratory illness, constipation and diarrhoea had occurred.

Material and methods. A survey was performed on 150 middle-school pupils aged 13-16 years. Correlation coefficients were determined between the frequency of consuming fermented drinks with the incidences of respiratory disease, constipation or diarrhoea.

Results. Most subjects declared that their state of health was satisfactory and that they regularly ate meals. Those consuming fermented milk drinks for over a year constituted 88%. It was found that 56% of all subjects drank such beverages at least once daily or several times a week. The decrease observed in consuming these drinks resulted in increasing problems of bowel evacuation ranging from 3% in those drinking daily to 26% that drank less than once monthly. The incidence of respiratory tract illness was seen to rise whenever fewer fermented milk beverages were consumed. Analogous findings were seen also in the incidence of diarrhoea. Subjects also considered that such drinks improved health and yoghurts were the most frequent type of these drinks consumed.

Conclusions. Gastro-intestinal function may be enhanced by regular consumption of fermented milk drinks together with a decreased incidence of respiratory tract illness. However, the effect of how often such drinks are consumed on the aforementioned conditions remains unresolved.

Key words: *immunity, dairy fermented beverages, diarrhoea, constipation, respiratory tract illness*

STRESZCZENIE

Wprowadzenie. Obecnie na rynku dostępnych jest szereg mlecznych napojów fermentowanych. Wiele z nich zawiera dodatkowo mikroflorę probiotyczną. Liczne badania pokazują, że młodzi ludzie chętnie spożywają tego typu napoje. Choroby dróg oddechowych są bardzo częste wśród młodzieży. Spośród dolegliwości układu pokarmowego nierzadkim problemem są zaparcia oraz biegunki.

Cel badań. Celem pracy było ocena wpływu spożywania mlecznych napojów fermentowanych na odporność organizmu nastolatków w wieku 13-16 lat poprzez analizę zależności pomiędzy częstotliwością spożywania napojów fermentowanych a występowaniem biegunek, zaparć oraz chorób dróg oddechowych.

Materiał i metoda. Analiz dokonywano na podstawie badań ankietowych przeprowadzonych wśród 150 uczniów gimnazjów w wieku 13-16 lat. W pracy wyliczono współczynniki korelacji pomiędzy spożywaniem mlecznych napojów fermentowanych a występowaniem biegunek, zaparć oraz chorób dróg oddechowych.

Wyniki. Badana grupa młodzieży w większości deklarowała dobry stan zdrowia oraz regularnie się odżywiała. Udział osób deklarujących spożywanie mlecznych napojów fermentowanych dłużej niż rok wyniósł 88%. 56% badanych gimnazjalistów spożywało mleczne napoje fermentowane codziennie lub kilka razy w tygodniu. Spadek częstotliwości spożycia napojów fermentowanych wśród gimnazjalistów spowodował zwiększenie udziału procentowego osób deklarujących problemy z wypróżnianiem z 3%, dla osób spożywających napoje fermentowane codziennie, do 26% dla spożywających je rzadziej niż raz w miesiącu. Procentowy udział osób z często występującymi infekcjami dróg oddechowych wzrastał wraz ze spadkiem częstotliwości spożywania mlecznych napojów fermentowanych. Podobne zależności stwierdzono w przypadku występo-

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wania biegunek. Ankietowani sądzą, że mleczne napoje fermentowane mogą przyczyniać się do wzmocnienia organizmu. Respondenci spośród mlecznych napojów fermentowanych najczęściej wybierali jogurty.

Wnioski. Regularne spożywanie mlecznych napojów fermentowanych może korzystnie wpływać na regulację pracy przewodu pokarmowego oraz rzadsze występowanie infekcji układu oddechowego. Nie wykazano jednoznacznego wpływu długości okresu spożywania mlecznych napojów fermentowanych na oceniane przypadłości.

Słowa kluczowe: *odporność, fermentowane napoje mleczne, biegunki, zaparcia, choroby dróg oddechowych*

INTRODUCTION

In recent years, there has been an increase in the number of fermented milk drinks that not only contain traditional bacterial strains but also in new products which have appeared and are intensively marketed as being pro-health drinks. These are based either on pasteurised milk (in using those bacteria isolated from the gastro-intestinal tract of healthy persons) or are linked to traditional strains containing mesophilic and thermophilic lactic acid bacteria [16]. The latest milk drinks consist of bio-yoghurts, bio-kefirs, acidophilus milk, acidophilus buttermilk and acti-products.

Lactic acid bacteria found in foodstuffs mainly consist of *Lactobacillus* and *Bifidobacterium* strains that are present in the lower gut and which are commonly termed as probiotic bacteria. Such fermented foodstuff products which are isolated from the gastro-intestinal tracts of healthy people, taste different, are weakly sour and have an ambiguous odour. However, these features may not be acceptable to consumers, so manufacturers of these new generation milk drinks try to make more appealing and attractive to the senses by employing various strategies. Beneficial bacteria of the lower gut are used together with traditional strains, and the taste is regulated by adding sugar, fruit extracts/juice, herbs and flavourings [11]. Often, probiotic bacteria are also added at the end of the production process, which provide organoleptic properties as well as beneficial gut microflora. Indeed, it is found that the latest of such fermented products additionally contain prebiotics, some proteins, peptides, fats and certain oligo/polysaccharides, thus selectively modifying the colonic microflora composition of the digestive system [15].

The immune system is very complex and highly specialised and its function is influenced by many factors. Amongst these is nutrition, although others like stress, fatigue and various diseases can also produce adverse effects [1]. Mucous membranes play a vital role in regulating mucosal immunity where mucosa-associated lymphatic tissue (MALT), constitutes a major component, together with certain lymphocyte types [13]. In the human body, 80% of all immunoglobulins are formed in the gut and at least 50% of all lymphocytes are located therein [4].

In order to confirm whether the effects of probiotics are beneficial to human health, many studies have focused on adverse effects such as diarrhoea (infectious, after taking antibiotics or the travellers' affliction), constipation, being infected with *Helicobacter pylori*, food allergies or intolerance, inflammatory bowel disease, respiratory tract infection and lactose intolerance [6].

Many studies indicate that fermented milk drinks have now become very popular amongst various consumer groups [10, 18, 19, 24]. Respiratory illness has also been found to be common in adolescents. In gastro-intestinal disorders, constipation or diarrhoea often feature. For these reasons the study aim was to assess the effect of consuming fermented milk drinks on immunity/resistance to various infections in adolescents aged 13-16 years. This was performed by determining the relationship between how frequently such drinks were consumed with the incidence of diarrhoea, constipation and respiratory disease/infection (i.e. influenza, colds, sore throats, bronchitis etc.).

MATERIAL AND METHODS

Subjects were 150 pupils aged 13-15 years attending middle school classes 1-3, living in the Lubelski province (voivodship) of Poland who had previously consented to be studied. The study tool was a questionnaire to which subjects directly gave their replies during interview, thus assuring 100% compliance. Research was carried out in April 2012.

The questions posed, concerned the subjects' assessment of their own health status, incidence of respiratory tract illnesses as well as constipation and diarrhoea, economic status, nutritional habits, diet and preferences and the frequency of consuming fermented milk drinks. Those about choosing fermented milk drinks and ones on how milk products were used when suffering from respiratory tract illness were open questions, with three possible replies and with an option of giving other answers to those already suggested. The remaining questions required making a definitive choice. Suffering from conditions of diarrhoea or constipation were not precisely defined and it was left to the judgement of the individual subject. Results were statistically analysed using the correlation coefficient calculation available from the options on the Microsoft Excel 2010 package.

RESULTS AND DISCUSSION

The subjects consisted of 51% girls and 49% boys with economic status and dietary habits being assessed at the beginning of the study; these being factors judged likely for affecting vulnerability to illness [1]. Those being very well off, or just well off were respectively 30% and 49%, whilst those of average means or poor were 16% and 5% respectively. The majority of pupils ate 4 or more meals daily (Table 1) and were not dieting; only a few were either on a slimming or protein diet. The self assessment of health status showed 37% claiming that this was very good and 45% as good, whereas 13% declared neither bad nor good health and 1 and 3% respectively saying their health was bad or very bad. However, overall, most were healthy and not malnourished, which could of been likely factors for lowered immunity and thus might of had a significant effect on the results.

Table 1. The number of daily meals consumed and types of diet adopted by pupil subjects (%)

Study categories		Girls	Boys	Total
Number of meals	Less than 3	16	0	7
	3	14	16	17
	4	42	28	35
	5 or more	28	56	41
Adopted diet	Slimming	25	3	14
	Protein	1	7	4
	Carbohydrate	0	3	1
	Low fat	7	3	5
	No special diet	67	85	76

Figure 1 shows the effect of consuming fermented milk drinks on the incidence of being constipated, expressed as numbers declared and their respective percentages. It was found that 56% pupils drank such products at least several times weekly. It was clear that the observed increase in drinking these products was correspondingly related to the lack of having problems with constipation; ranging from those consuming fermented milk drinks less than once per month at 16% to those daily at 41%. Another obvious trend was that the more subjects had problems with bowel movements, then the less fermented milk drinks were consumed i.e. from 3% of those drinking such drinks daily to 26% who drank less than once per month. This was confirmed by an observed correlation between the frequency of consumption with the incidence of having constipation. A scale of 1 to 5 was adopted for classifying the frequency of consuming the milk drinks ranging from '1' as less than once monthly to '5' as daily. A correlation coefficient of -0.9 was observed with the incidence of being constipated in the last 6 months within the first category and rose progressively to 0.96 in category 5,

with those declaring an absence of being constipated. It can thus be inferred that regular and frequent consumption of fermented milk drinks is associated with normal bowel habits.

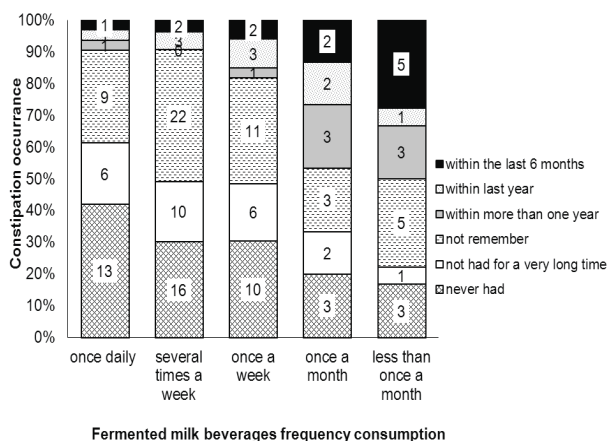


Figure 1. The effect of fermented milk beverages frequency consumption on constipation occurrence. The numbers put in the columns refer to the number of respondents declarations

The effect of for how long fermented milk drinks had been drunk on the incidence of constipation is presented in Figure 2. No clear trends are visible, with the exception that a relation was seen with the first three categories describing the habits of drinking such beverages (i.e. 'since when I can remember', 'for several years' and 'for one year'). Nevertheless, those who only started regularly drinking these milk products within the last month did not have constipation problems. There were in fact 18 subjects (12%) who had started consuming these drinks within the last year or less.

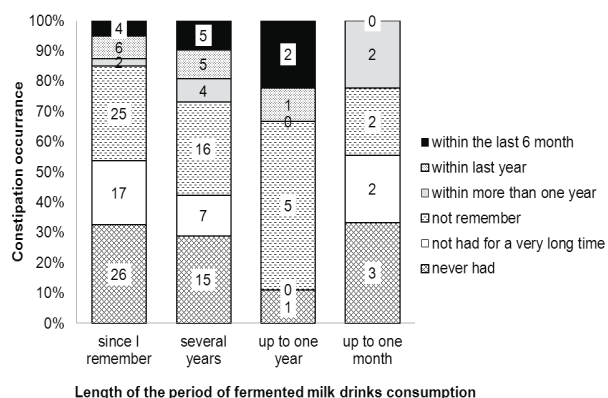


Figure 2. The effect of the length of the period of fermented milk drinks consumption on constipation occurrence. The numbers put in the columns refer to the number of respondents declarations.

It is seen that constipation is a very common in children and the elderly. Many studies have been con-

ducted on what effects probiotics have when bowel transit times are long in cases of constipation. Yoghurts so used contain live bacteria such as *L. casei Shirota*, *B. animalis*, *L. acidophilus*, and *B. longum*, in combination with lactulose. Because of the many different methods used, the results were equivocal, where the various effects observed seem likely to depend on the strain [8]. Tabbers et al [23] demonstrated a beneficial effect of *Bifidobacterium breve* and *Bifidobacterium animalis subsp. lactis* for treating constipation in children. However Russo et al [20] showed that products containing *Lactobacillus paracasei* facilitate constipation.

Figure 3 describes the frequency of fermented milk drink consumption on the incidence of respiratory illness, where only weak trends are observed as shown by the correlation between these factors. As in Figure 1, a '1' to '5' scale was adopted for the frequency of contracting illness, ranging from '1' as being less than once monthly to '5' as being daily. For subjects becoming ill several times per year, the correlation coefficient was -0.85 for category 1 whilst those falling ill less than once per year this was 0.67 for category 5. It would thus appear that a high consumption of these drinks limits the times of falling ill.

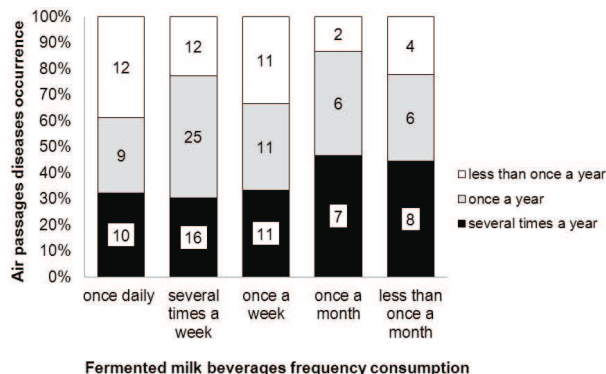


Figure 3. The effect of fermented milk drinks frequency consumption on the air passages diseases occurrence. The numbers put in the columns refer to the number of respondents declarations.

There was little relation between the duration of having consumed fermented milk drinks and the incidence of suffering from respiratory illness (Figure 4); no matter how long these drinks had been drunk, the likelihood of respiratory illness was similar. This may be due to the short survival rate of the probiotic bacteria. These bacteria when introduced into the gastro-intestinal tract have short term effects on the body after which they die unless prebiotics are not also supplied. It is only in the presence of prebiotics that the numbers of probiotic bacteria flourish to maintain and increase their levels [7]. When probiotics are consumed without regular prebiotics, then such bacteria can survive a certain time

in the colon which may be sufficient to elicit increased resistance to illness as shown previously in Figure 3.

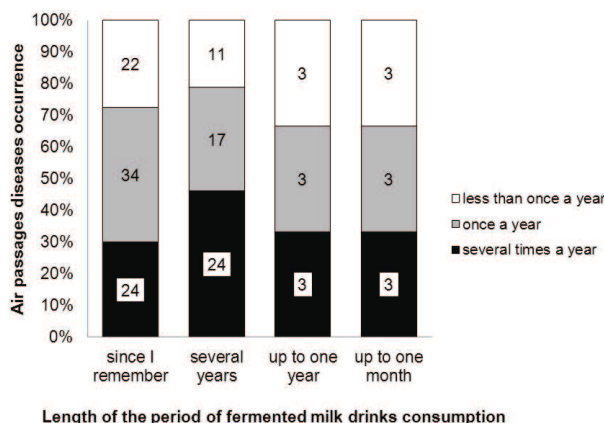


Figure 4. The effect of the length of the period of fermented milk drinks consumption on the air passages diseases occurrence. The numbers put in the columns refer to the number of respondents declarations.

Infections of the respiratory tract such as colds/flu, sinusitis, sore throat, epiglottitis, tonsillitis, otitis media, bronchitis or pneumonia are found to commonly occur in children and the elderly. They are caused either by viruses or bacteria. According to Zmarlicki [25], bacteria in yoghurts may exhibit immunological action. Clinical studies have demonstrated that subjects eating yoghurts or a preparation of bacteria so derived, increases α -interferon levels in serum as well as natural killer (NK) lymphocytes. Other work has shown that giving *Lactobacillus delbrueckii ssp. bulgaricus*, in yoghurt sticks or *Lactobacillus casei* increases phagocyte activity and macrophage lysosome secretion in the peritoneum. The altered gut microflora induces an abnormal immunological response to exogenous antigens and even to native gut microflora. A lack of both gut bacteria and Regulatory T Cells (Tregs) activation in the immune system may increase the activity of Th1 or Th2 lymphocytes leading to the development of chronic

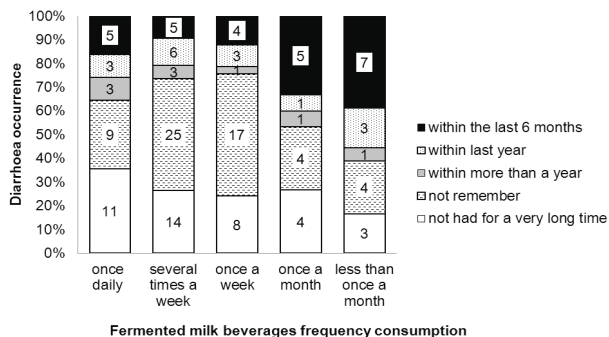


Figure 5. The effect of fermented milk drinks frequency consumption on diarrhoea occurrence. The numbers put in the columns refer to the number of respondents declarations.

inflammatory and autoimmune diseases, as well as allergies. Probiotics affect the cytokine balance between Th1 and Th2 and thus may have beneficial effects on the courses of inflammatory disease and allergies [5].

A definite trend is observed between how often fermented milk drinks are consumed and the incidence of diarrhoea (Figure 5). In the case of the two categories given, at the extremes of diarrhoea incidence, the correlation coefficients are very high; 0.88 for those never suffering from diarrhoea and -0.83 in those who had diarrhoea in the last 6 months. Frequent consumption of fermented milk drinks is thus seen to limit the incidence of diarrhoea in the studied pupils.

The length of time that fermented milk drinks had been previously consumed was found to be independent of diarrhoea incidence (Figure 6); in a similar fashion to constipation and respiratory illness.

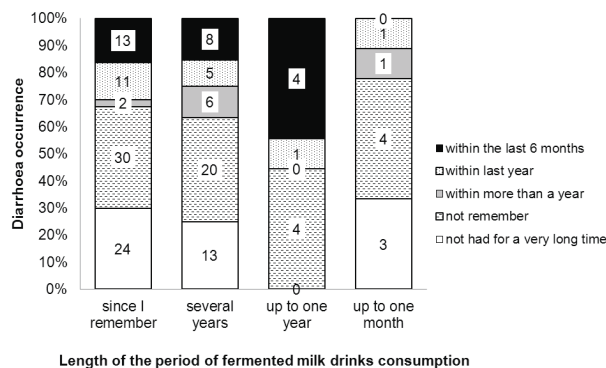


Figure 6. The effect of the length of fermented milk drinks consumption on diarrhoea occurrence. The numbers put in the columns refer to the number of respondents declarations.

Probiotics have been shown to decrease the course of infectious diarrhoea by about 30 hours, reducing both the risk for this disorder to last more than 3 days, and the mean amounts of bowel movements passed [3]. It was concluded that these types of microorganisms form a useful part of rehydration therapy in children and the elderly. Cases of diarrhoea after taking antibiotics occur in 5-30% of adults and 11-40% children [17, 22]. Consuming appropriate bacterial strains may however prevent this from happening. They may limit the growth of pathogenic bacteria by releasing inhibitors which have been demonstrated in various *in-vitro* studies. Indeed, *McFarland et al.* [14] showed that taking probiotics is effective in preventing traveller's diarrhoea.

The presented study also looked at the different kinds of fermented milk drinks consumed where subjects could select up to 3 products. Almost 30% chose yoghurts that were natural, fruit or grain/cereal types. The remaining products were however less often drunk (10-15%), whilst those supplemented with beneficial microflora probiotics were taken the most rarely at 7%.

At present, there are around 50% of yoghurts on the market that contain probiotics which mainly consist of *Bifidobacterium lactis*, *Lactobacillus acidophilus* and *Lactobacillus casei*. In the question section on yoghurt products supplemented with beneficial probiotic microflora on the market, it was intended to tease out the level of knowledge and awareness that pupils had on this issue. It is thereby probable that a large part of the yogurts consumed did indeed contain probiotics but only a few subjects were aware of this.

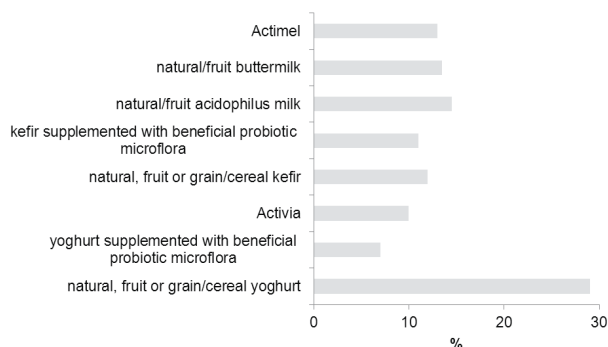


Figure 7. The most often consumed fermented milk drinks

A survey by *Jeżewska-Zychowicz* [9] demonstrated that fermented milk drinks containing fruit were most commonly consumed by 13-15 year-olds. Similar findings were seen in studies on 15-19 year-old students. Another study by *Adamczyk* [2] showed that yoghurts were the most favourite dairy product in adolescents. Likewise *Kudelka* and *Marzec* found the same, but that also probiotic milk had the lowest popularity which was explained by it being the least attractive and appealing to the senses.

Foodstuff products that were most commonly consumed by subjects in order to bolster their immunity during the autumn and winter seasons consisted of lemon tea with honey (29.4%) and home-made raspberry juice (26%). Others also reported were; onion/garlic (17.2%), fermented milk drinks (10.2%), lime-tree flower tea (5%), milk with honey (3.2%), cod liver oil (1%) and rose-hip tea (1%). Some (7%) however, never took any traditional remedies recognised to be beneficial in promoting resistance to infection.

It should be noted that 65% of subjects were convinced that consuming fermented milk drinks can increase resistance to infection, whilst 21% expressed no opinion and 14% claimed that there was no such effect.

CONCLUSIONS

1. Regular and frequent consumption of fermented milk drinks may benefit the regulation of gastro-intestinal

- function and decrease the incidence of respiratory illnesses.
2. There was no unequivocal effect seen of how long fermented milk drinks had been consumed on the times suffered from illness
 3. The majority of subjects were convinced that fermented milk products can boost health, however in practice, the most commonly adopted means for protecting against illness were by consuming home-made raspberry juice and lemon tea with honey.

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Conflict of interest

The authors declare no conflict of interest.

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