

## OSMOLALITY OF ISOTONIC DRINKS IN THE ASPECT OF THEIR AUTHENTICITY

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Key words: isotonic drinks, osmolality, authenticity of product.

### Abstract

Isotonic drinks belong to a group of products which are becoming more and more popular among teenagers, sportsmen, as well as the elderly and fitness-oriented people. The proper osmolality of isotonic drinks should be of 300 mOsm kg<sup>-1</sup> of water ±10%. The objective of this study is to analyse whether the isotonic drinks available on the Tricity market (the area of three cities: Gdańsk, Sopot, Gdynia) are authentic isotonic drinks. For the purpose of the study 25 bottles of isotonic drinks of different brands and flavours have been purchased. The osmolality of the majority of the drinks was within the recommendations of European Union – from 270 to 330 mOsm kg<sup>-1</sup> of water. Twelve of the drinks have not got the osmolality declared by the manufacturers. Six of them have not met the requirements for an isotonic drink (two of these had not been declared to be isotonic drinks). It seems that manufacturers should observe the quite broad limit of osmolality and the criterion of osmolality is the evidence for their authenticity.

## BADANIE OSMOLALNOŚCI NAPOJÓW IZOTONICZNYCH W ASPEKTCIE ICH AUTENTYCZNOŚCI

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Słowa kluczowe: napoje izotoniczne, osmolalność, autentyczność produktów.

### Abstract

Napoje izotoniczne są coraz popularniejszą grupą towarów kupowaną zarówno przez młodzież, sportowców, jak i osoby starsze dbające o swoją formę. Powinny charakteryzować się osmolalnością 300 mOsm kg<sup>-1</sup> wody ±10%. Celem pracy było stwierdzenie, czy napoje obecne na rynku trójmiejskim

są autentycznymi izotonikami. Zakupiono 25 napojów izotonicznych różnych marek o wielu smakach. Większość badanych napojów miała osmolalność w granicach rekomendowanych przez Unię Europejską – od 270 do 330 mOsm kg<sup>-1</sup> wody. Dwanaście napojów nie miało deklarowanej przez producenta osmolalności. Spośród badanych napojów sześć z nich nie spełniało warunków napoju izotonicznego (w tym dwa nie były deklarowane jako izotoniczne). Wydaje się, że dość szeroka granica osmolalności powinna być przez producentów przestrzegana, zaś kryterium osmolalności jest dla napojów izotonicznych wyrazem ich autentyczności.

## Introduction

Isotonic drinks belong to a group of functional beverages. It is relatively a new category of products on the domestic market. Due to their properties, isotonic drinks are used to replenish the loss of fluids in a human body, especially after physical work out. These drinks may also be helpful during dehydration therapy. Isotonic drinks are intended to restore the loss of water and minerals such as sodium, potassium, calcium and magnesium ions in result of sweating during physical work out. The osmolality of the drinks depends on their ingredients. They contain carbohydrates, ions of sodium, calcium, magnesium, potassium and chloride as well as vitamins, especially B vitamins (AMENDOLA et al. 2004). Due to the fact that osmolality of these drinks is similar to the osmotic pressure of the human blood, the ions and water are absorbed relatively quickly. Previously, the sports drinks of osmolality from 275 to 295 mOsm kg<sup>-1</sup> of water were considered as isotonic. Currently, according to the European Union regulations, drinks containing the osmolality of 300 mOsm kg<sup>-1</sup> of water  $\pm$  10%, that is from 270 to 330 mOsm kg<sup>-1</sup> of water are isotonic drinks (Report of the Scientific Committee on Food... 2001). Beverages of lower isotonicity are considered as being hypotonic, and these of higher isotonicity to be hypertonic.

## The objectives of the study and grounds for research

Isotonic drinks are in the same groups as energy drinks on the domestic market and their sales rates are calculated together. 80% of the sale of functional drinks includes energy drinks and about 20% are isotonic drinks (the figures may differ slightly for different periods of sale). However, the sale of isotonic drinks has been increasing and it is expected that their sale growth will continue on the market. Supermarkets have been introducing isotonic drinks under their own trade names (private label). This makes the drinks more affordable and available for younger customers. The manufacturers attempt to create an attractive packaging for the drinks (cans, PET bottles of

different volume) and they introduce a variety of flavours and colours of isotonic drinks. This leads to the extension of the offer for customers. The increasing sale of isotonic drinks is also caused by changes in human behaviour. A healthy lifestyle, sports and recreation (e.g. jogging, biking, Nordic walking) are being promoted. The consumers choose isotonic drinks to replenish the amount of water and electrolytes in their bodies.

The market of isotonic drinks is a prospective market. Many new drinks have been introduced into the market. Many of them are of private label and thus of a lower price. Thus the drinks are getting more and more available to low income and young customers. According to Nielsen's report, 26.75 million of litres of isotonic drinks were sold for the price of 149 million PLN in the period from February 2011 to January 2012. (That is 21.4% of the whole isotonic and energy drinks market). With regard to the volume, the sale increased 10.8% in comparison to the period from February 2010 to January 2011 (the sale was 113 million of litres). This might reflect the potential of this market. The packaging of the drinks is also of importance in terms of purchasing. The majority of isotonic drinks packaging are PET bottles of 500 ml volume, a lower number of packagings include 250 ml cans. PET bottles of 750 ml (Oshee) and 700 ml (4move) volume are new on the market. According to TGI research done by Millward Brown Institute SMG/KRC, the most frequently consumed isotonic drink in the period from January 2011 to December 2011 was Powerade (ZASADA 2012). However, according to the research of BŁASZCZYK et al. (2012), the most popular drinks were Powerade and Oshee.

Isotonic drinks are considered as sportsmen's beverages. Many studies are being conducted in order to analyse the influence of different doses of sugars, types of sugars, ions of sodium, potassium and vitamins on the efficiency of a sportsmen's body, their speed and exercising capacity. The research on the optimal composition of isotonic drinks are to provide better results for sportsmen. The ability to replenish fluids in a human body by drinking water and isotonic drinks is also subject to analysis. An insufficient fluid intake results in dehydration of the body. There are three types of dehydration, mild dehydration (about 1% loss of body weight), moderate dehydration (about 4% loss of body weight) and severe dehydration (about 10% loss of body weight which requires emergency care). It is well known that the replenishment of water lost during exercising is one of the most important parameters controlled by coaches and physicians supervising their sportsmen (PASSE et al. 2009, EWANS et al. 2009, HILL et al. 2008).

One of the first researches on isotonic drinks was conducted by a consumer organization and was published in *Świat Konsumenta* (now ProTest) magazine in 2003 and 2007 (ANONIM 2003, ANONIM 2007). The isotonicity of the

drinks was one of assessment criterions. It is the osmolality that is essential in terms of the authenticity of these drinks.

Therefore, the objective of this study was to confirm the authenticity of isotonic drinks purchased on Tricity market on the basis of their osmolality.

## **Method**

For the purpose of this study, 25 isotonic drinks of different brands have been purchased in supermarkets (Polo, Lidl, Biedronka, Auchan, Delikatesy ALBO) in the area of Tricity and its surroundings to be analysed in terms of their osmolality. Only the beverages available in supermarkets have been taken into consideration. The homemade (powdered) isotonic drinks have not been analyzed. The purchased isotonic drinks included the following drinks: Isostar, 4move, BE Sport, Oshee, Kite, Siti, Gatorade, Powerade and Iso Fresh. The drinks have been coded. The osmolality has been measured with Marcel® OS3000 osmometer (product of Poland – Marcel Sp. z o. o.). The reference standard was Funke Gerber calibration standard of the following parameters: -0.557°C and 300 mOsm. The osmometer measures the exact freezing point of the liquid and the temperature is later calibrated with calibration solution. The drinks had different packagings, the majority of them were PET bottle of 500 ml, 555 ml, 700 ml, 750 ml volume and 250 ml cans. The research was conducted on the drinks in the period from March to April 2013 before their expiry date.

## **Results and Discussion**

The results of the research are presented in Table 1.

Table 1 also shows the value of osmolality declared by a manufacturer. Up to 12 drinks do not provide any information about their osmolality on their labels. It seems that such information should be included on the drink's label because it confirms the isotonicity of the particular drink and also the fact that the manufacturer has examined its essential parameters. Of all analysed drinks, 6 have not had the proper osmolality for their group of drinks, 2 of them have not had any declaration of isotonicity (drinks no. 4 and no. 9). The drinks with non-declared isotonicity have been purchased at the isotonic drinks shelf in the supermarket. This leads to inappropriate recognition by customers. Drinks no. 11 and no. 12 are hypotonic drinks and drinks no. 20 and no. 23 are hypertonic drinks. The differences between the manufacturer's declaration and the osmolality measurement are minor for the majority

of drinks. From 25 analyzed drinks only 19 are authentic isotonic drinks. If the narrower scope of osmolality range, that is 275–295 mOsm kg<sup>-1</sup> of water, was taken into consideration, only 15 out of 25 drinks would comply with the osmolality criterion. In some opinions, the range of osmolality recommended by European Union is too wide, and therefore only one of the analyzed drinks may be considered as an isotonic drink (MAUSER 2011).

Table 2 shows the contents of carbohydrates, sugars and sodium declared by the manufacturers of the isotonic drinks. The data in this table confirm that drinks no. 4 and no. 9 are certainly not isotonic drinks as the contents of sugars

Table 1

Osmolality of isotonic drinks

No. of drink	Drink code	Taste	Measured osmolality	Declared osmolality
			[mOsm kg <sup>-1</sup> of water]	[mOsm kg <sup>-1</sup> of water]
1	A	multifruit	289	288
2	A	lemon	297	288
3	B	cherry	289	290
4	B	apple, white grapes, pear	155	–
5	B	arapefruit	290	289
6	B	orange	290	285
7	B	lime, mint	287	290
8	B	lemon	277	290
9	B	multifruit	52	–
10	C	blueberry	279	–
11	D	multifruit	232	–
12	D	grapefruit	228	–
13	E	blackberry	311	–
14	E	lemon	281	–
15	F	lemon	281	–
16	F	blueberry	283	–
17	G	red orange	306	304
18	G	mango	288	294
19	G	multifruit	293	294
20	H	lime, mint	334	307
21	H	blueberry	282	284
22	H	lemon	287	296
23	I	lemon	337	–
24	I	orange	305	–
25	I	grapefruit	318	–

and carbohydrates differs too much from the contents in other drinks. The value for drink no. 4. is 2.7 g of carbohydrates (incl. 2.7 g of sugars) per 100 ml of the drink and for drink no. 9. is 0 g of carbohydrates (incl. 0.0 g of sugars) per 100 ml of the drink. For the other drinks the contents of carbohydrates is between 3.9 to 6.7 g per 100 ml, including 3.8 to 6.0 g of sugars per 100 ml. The contents of sodium in the analyzed drinks has also been different and has oscillated between 43 and 72 mg per 100 ml of liquid. The majority of the analyzed drinks have had the sodium contents of 45–50 mg/100 ml. The content of sodium influences the osmolality of the drink because sodium ions participate in osmosis.

Table 2

The content of carbohydrates, sugars and sodium in isotonic drinks declared by manufacturers

No. of drink	Drink code	Taste	Carbohydrates	Sugars	Sodium
			[g/100 ml]	[g/100 ml]	[mg/100 ml]
1	A	multifruit	6.0	4.3	72
2	A	lemon	6.0	4.3	72
3	B	cherry	5.7	4.0	45
4	B	apple, white grapes, pear	2.7	2.7	<20
5	B	grapefruit	5.7	4.0	45
6	B	orange	5.7	4.0	45
7	B	lime, mint	5.4	3.9	45
8	B	lemon	5.7	4.0	46
9	B	multifruit	0	0	38
10	C	blueberry	5.4	3.8	–
11	D	multifruit	5.4	3.8	43
12	D	grapefruit	5.4	3.8	43
13	E	blackberry	6.0	6.0	50
14	E	lemon	6.0	6.0	50
15	F	lemon	5.4	3.8	50
16	F	blueberry	5.4	3.8	50
17	G	red orange	6.0	6.0	50
18	G	mango	3.9	3.9	50
19	G	multifruit	3.9	3.9	50
20	H	lime, mint	6.7	5.8	50
21	H	blueberry	5.4	3.8	50
22	H	lemon	5.4	3.8	50
23	I	lemon	6.7	5.5	70
24	I	orange	6.7	5.5	70
25	I	grapefruit	6.7	5.5	70

Also the research conducted by *Świat Konsumenta* (2003 and 2007), the isotonicity has not been stated in the drinks declared to be isotonic drinks (ANONIM 2003, ANONIM 2007). Also the research on osmolality conducted by METTLER et al. confirms that not all of the isotonic drinks have got appropriate rate of osmolality. The Swiss research aimed to analyze the osmolality of purchased liquid drinks as well as powdered drinks to be made at home. The different ranges of osmolality have been also taken into consideration. According to Swiss' law drinks of osmolality of 250–340 mmol/l may be considered as isotonic drinks, whereas the actual range of osmolality for an isotonic drink is 280–290 mmol kg<sup>-1</sup>. However, even applying the wider range of osmolality, some of the drinks declared as isotonic have not been confirmed as isotonic (METTLER et al. 2006).

As the market of functional drinks has been in a continuous progress the manufacturers have been introducing new isotonic products by adding new flavours or changing the ingredients (4 move has been the first brand in Poland to add stevia). Due to this fact, the osmolality of these drinks should be monitored carefully. It is also essential to analyse any homemade powdered drinks because there is a group of consumers of these products.

The analysis of the osmolality is therefore a verification method for the authenticity of an isotonic drink.

## Conclusions

1. The majority of the analysed isotonic drinks have the osmolality rate recommended by the European Union for their group of drinks (300 mOsm kg<sup>-1</sup> of water  $\pm$  10%). This is a proof of their authenticity.

2. The differences between the osmolality declared by manufacturers and the measured osmolality are minor.

3. The contents of carbohydrates in the analysed isotonic drinks oscillated between 3.9 and 6.7 g per 100 ml, and the contents of sodium oscillated between 43 and 72 mg per 100 ml of the drink. Both the contents of carbohydrates and sodium determine the rate of osmolality.

4. Isotonic drinks available on the market should be, therefore, monitored in terms of their osmolality.

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