

EFFECT OF BREAKFAST CONSUMPTION ON BODY MASS INDEX (BMI)

Petya Hristova^{1*}, Rozalina Yordanova², Magdalena Platikanova¹

¹Department of Hygiene, Epidemiology, Microbiology, Parasitology, and Infectious Diseases, Medical Faculty, Trakia University, Armeyska 11, 6000 Stara Zagora, Bulgaria

²Medical College, Trakia University, Armeyska 9, 6000 Stara Zagora, Bulgaria

*e-mail: petia_14_1995@abv.bg

Abstract

Breakfast is one of the main meals of the day, which is essential for health. It is often defined as “the most important meal of the day” because it is the first meal after the break and fasting at night. Breakfast is the meal that should be balanced to provide the necessary energy for the day and to maintain better health. The purpose of the present study is to investigate the relationship between breakfast intake, its type and time of consumption, and body mass (BMI) values, which are directly related to health.

To carry out the study, a survey was conducted on the eating habits of 533 people (322 women and 211 men) aged 18 to 65 from the Stara Zagora region, Bulgaria. Anthropometric studies were performed - height and weight measurements, respectively, with a portable stadiometer and a calibrated electronic scale. The respondents' BMI was calculated. The results were processed with SPSS Statistics and the relationship between breakfast consumption and body mass index (BMI) was investigated.

The results show that a normal BMI corresponds to a regular breakfast in the morning in 52.5% of cases. The time of breakfast around 8 a.m. is confirmed as the most suitable. According to the data, 41.3% of people of normal weight have breakfast at this time. The healthiest breakfast foods are fruits and vegetables. The unhealthiest breakfast is pasta.

Breakfast retains its role as the main meal; more studies are needed to establish its relationship with the value of BMI and, accordingly, discover the risk factors for its increase and the unlocking of various diseases. Knowing these data would improve the prevention of several socially significant diseases and therefore the population's health.

Key words: Breakfast, Meal, Diet, Body mass index, Healthy eating.

1. Introduction

Today, worldwide, increasing levels of overweight and obesity are among the leading health problems. Obesity is increasingly defined by various authors as a „world epidemic“. According to data from the World Health Organization (WHO), in the last four to five decades, the number of overweight or obese people has tripled [1]. Due to this fact, the study of eating habits and their influence on weight and health is extremely important.

A key dietary habit with a determining effect on body mass index (BMI) values is breakfast consumption. Breakfast is one of the main meals of the day, which is essential for health. It is often defined as „the most important meal of the day“ because it is the first meal after the break and fasting at night [2, 3]. One of the main questions that are increasingly emphasized is how eating or skipping breakfast affects the body mass index, as well as the time of consumption and the type of food consumed. Many experts in nutrition and dietetics and English, American, and Australian scientists provide recommendations for the consumption of a healthy breakfast as part of an optimal and balanced diet [4, 5, and 6]. There is data in the literature, although with little evidence, that skipping breakfast as one of the main meals of the day can lead to weight gain and the appearance of being overweight and obese [7]. In addition, according to several authors, the time of breakfast consumption is also important, as it affects metabolism [8]. According to other scientists, an earlier breakfast, a long sleep, as well as a break in fasting, and more frequent meals

ensure a better quality of diet and, consequently, health and quality of life. Additional data are needed to prove or reject the relationship between breakfast consumption and BMI because at this stage the metabolic effects of breakfast are an unresolved issue among the scientific community worldwide from several aspects - consumption, type of food, and time of intake [9, 10].

The purpose of the present study is to investigate the relationship between breakfast intake, its type and time of consumption, and body mass (BMI) values, which are directly related to health.

2. Materials and Methods

To carry out the study, a survey was conducted on the eating habits of 533 people (322 women and 211 men) aged 18 to 65 from the Stara Zagora region, Bulgaria. Anthropometric studies were performed - height and weight measurements, respectively, with a portable stadiometer and a calibrated electronic scale. The respondents' BMI was calculated.

The results were processed with SPSS Statistics and the relationship between breakfast consumption and body mass index (BMI) was investigated.

3. Results and Discussion

The present study examined the relationship between body mass index to breakfast consumption. It found that among people who have a normal weight based on BMI, the largest percentage eat breakfast regularly

in the morning - 52.5%, followed by 24.3% who eat breakfast sometimes. Of the people with a normal weight, only 23.2% reported that despite skipping breakfast in the morning, they remained in the optimal values and fell into the second BMI group.

Among the overweight sample, the percentage of people who eat breakfast is again the highest, 52.5%, followed by those who eat breakfast sometimes - 24.3% and those who do not eat breakfast - 23.2%. These results were further analyzed because, in addition to the consumption of breakfast, the time of consumption and the type of food consumed are also assumed to influence BMI. Among respondents who have breakfast in the morning, 42.9% are underweight, 37.7% are normal and only 19.4% are overweight. This shows that eating breakfast leads to lower and healthier values of BMI and weight (Table 1).

In addition to these data, the influence of the time it is consumed on BMI was also examined. The results show that 8 a.m. is confirmed as the most appropriate time for breakfast, as 41.3% of people with normal weight have breakfast around 8 a.m. and 22.5% of respondents with normal weight have breakfast until 7 a.m. or 9 a.m., respectively.

The most unfavorable is the later breakfast, around 10 a.m., since only 13.8% of the people who consume their breakfast at that time are of normal weight.

Early breakfast - until 7:00 a.m. also has a positive effect on BMI. The results show that of those who have

Table 1. Distribution of respondents by BMI groups and breakfast consumption

Answers		BMI groups			Total	
		Underweight	Normal	Overweight and obese		
Breakfast consumption	No	Count	67	41	17	125
		Expected count	60.2	42.8	22	125
		% within code-breakfast	53.60%	32.80%	13.60%	100.00%
		% within BMI groups	26.90%	23.20%	18.70%	24.20%
	Sometimes	Count	76	43	26	145
		Expected count	69.8	49.6	25.5	145
		% within code-breakfast	52.40%	29.70%	17.90%	100.00%
		% within BMI groups	30.50%	24.30%	28.60%	28.00%
	Yes	Count	106	93	48	247
		Expected count	119	84.6	43.5	247
		% within code-breakfast	42.90%	37.70%	19.40%	100.00%
		% within BMI groups	42.60%	52.50%	52.70%	47.80%

breakfast early, before 7 a.m., 41.3% are of normal weight, followed by those with underweight - 27.3% and the smallest percentage with overweight - 21.3%. These data show that early breakfast is more often associated with lower BMI and normal weight (Table 2).

Of particular importance for weight is also the type of breakfast products consumed. From the results, the percentage distribution among those consuming fruits and vegetables for breakfast is particularly impressive. 67.8% of respondents who consume fruit for breakfast are underweight. 28% are of normal weight and only 4% are overweight.

Among people who eat vegetables for breakfast, 25% are underweight and 75% are normal weight. It is impressive that none of the participants (0%) in the study who had greens for breakfast were overweight. When consuming dairy products for breakfast, overweight people are 16%, and when it comes to pasta products - 21.2%. Therefore, the healthiest breakfast foods are fruits and vegetables, since people who consume them are less likely to be overweight and obese. The most unhealthy is the pasta breakfast, but also the most frequently consumed among the respondents. The largest percentage of people who are overweight (65.7%) consume this type of food (Figure 1).

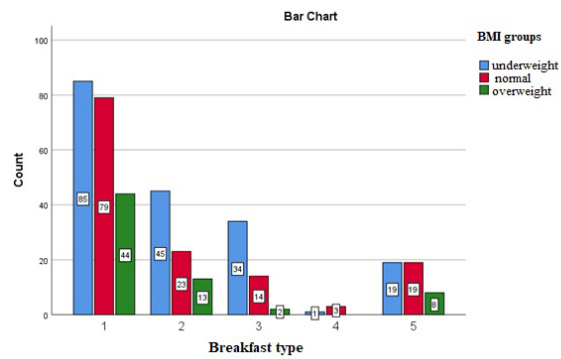


Figure 1. Distribution of respondents by BMI groups and type of breakfast
Coding of the food groups: 1 - Pastry; 2 - Dairy products; 3 - Fruits; 4 - Vegetables; 5 - Other

Many German scientists have emphasized the importance of breakfast through their studies. They found the link between skipping breakfast and body weight to be controversial. Through a systematic review and meta-analysis, they summarized the results by including prospective studies in which breakfast was skipped as a predictor of overweight and obesity. Although minimal, the evidence from this study suggests that skipping breakfast as one of the main meals of the day can lead to weight gain [11].

Table 2. Distribution of respondents by BMI groups and time of breakfast

Answer		BMI groups			Total	
		Underweight	Normal	Overweight		
Breakfast time	Until 7 a.m.	Count	28	31	16	75
		Expected count	35.8	25.9	13.3	75
		% within code-breakfast time	37.30%	41.30%	21.30%	100.00%
		% within BMI groups	14.70%	22.50%	22.50%	18.80%
	8 a.m.	Count	66	57	36	159
		Expected count	75,9	54.9	28.2	159
		% within code-breakfast time	41.50%	35.80%	22.60%	100.00%
		% within BMI groups	34.60%	41.30%	50.70%	39.80%
	9 a.m.	Count	46	31	11	88
		Expected count	42	30.4	15.6	88
		% within code-breakfast time	52.30%	35.20%	12.50%	100.00%
		% within BMI groups	24.10%	22.50%	15.50%	22.00%
10 a.m.	Count	51	19	8	78	
	Expected count	37.2	26.9	13.8	78	
	% within code-breakfast time	65.40%	24.40%	10.30%	100.00%	
	% within BMI groups	26.70%	13.80%	11.30%	19.50%	

Numerous studies by other scientists around the world also support these claims by reporting an increased relative risk of overweight/obesity among people who skip breakfast. These studies reported that this eating habit leads to weight gain [11 - 14]. On the other hand, Nooyens *et al.*, [15], reported that as the frequency of breakfast increases, so does the risk of weight gain.

Studies by American scientists believe that consistency in breakfast consumption is more important than frequency. The results they reported showed that those who ate breakfast 7 days a week had an 11% to 17% lower risk of being overweight or obese compared to those who ate breakfast infrequently - up to 3 - 6 times a week. People who have established a habit of never eating breakfast also have a lower risk (11 to 22% less) compared to irregular breakfast eaters. The results suggest that a regular breakfast can be defined as the main method for maintaining a normal weight [16].

Other studies have indicated that breakfast reduces the relative risk of being overweight, and obese (with higher BMI values) [16 - 19]. Some authors are supporters of the same concept but formulated oppositely. According to them, skipping breakfast leads to an increased risk of being overweight and obese [13, 14].

There is also data in the literature regarding the timing of breakfast that is consistent with our results. They support the claim that an earlier breakfast is the optimal choice [8, 20].

Additionally, a positive relationship was found between fruit and vegetable consumption and BMI, which is also in sync with our results [21, 22].

More convincing data on the relationship between breakfast and BMI are needed to make clear and definitive recommendations about eating breakfast to improve health in the future.

4. Conclusions

- We can conclude that there is an association between breakfast consumption and BMI.
 - Eating breakfast leads to lower and healthier BMI values.
 - Early breakfast is more often associated with lower BMI and normal weight.
- The healthiest breakfast foods are fruits and vegetables.

5. References

- [1] WorldHealthOrganization.(2021).*ObesityandOverweight*. <URL:https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. Accessed 18 June 2022.
- [2] Andersen B. (2013). *Breakfast - A History*. Rowman and Littlefield, Lanham, USA.
- [3] Gibney M. J., Barr S. I., Bellisle F., Drewnowski A., Fagt S., Livingstone B., Masset G., Varela Moreiras G., Moreno L. A., Smith J., Vieux F., Thielecke F., Hopkins S. (2018). *Breakfast in Human Nutrition: The International Breakfast Research Initiative*. *Nutrients*, 10, (5). DOI:10.3390/nu10050559. Accessed 18 June 2022.
- [4] American Academy of Nutrition and Dietetics. (2018). *Power Up with Breakfast*. <URL:https://www.eatright.org/food/planning/meals-and-snacks/power-up-with-breakfast. Accessed 19 June 2023.
- [5] British Dietetic Association. (2018). *Healthy Breakfast*. <URL: https://www.bda.uk.com/resource/healthy-breakfast.html. Accessed 19 June 2023.
- [6] Dietitians Association of Australia. (2018). *Breakfast*. <URL:https://dietitiansaustralia.org.au/taxonomy/term/155. Accessed 19 June 2023.
- [7] Lopez-Minguez J., Dashti H. S., Madrid-Valero J. J., Madrid J. A., Saxena R., Scheer F., Ordonana J. R., Garaulet M. (2019). *Heritability of the timing of food intake*. *Clin. Nutr.*, 38, pp. 767-773.
- [8] Lesani A., Barkhidarian B., Jafarzadeh M., Akbarzade Z., Djafarian K., Shab-Bidar S. (2023). *Time-related meal patterns and breakfast quality in a sample of Iranian adults*. *BMC Nutr.*, 9. <URL:https://doi.org/10.1186/s40795-022-00666-w. Accessed 19 June 2023.
- [9] Wicherski J., Schlesinger S., Fischer F. (2021). *Association between Breakfast Skipping and Body Weight-A Systematic Review and Meta-Analysis of Observational Longitudinal Studies*. *Nutrients*, 13, (1). DOI:10.3390/nu13010272. Accessed 23 June 2023.
- [10] Lopez-Minguez J., Gómez-Abellán P., Garaulet M. (2019). *Timing of Breakfast, Lunch, and Dinner. Effects on Obesity and Metabolic Risk*. *Nutrients*, 11, (11). DOI:10.3390/nu11112624. Accessed 23 June 2023.
- [11] Goto M., Kiyohara K., Kawamura T. (2010). *Lifestyle risk factors for overweight in Japanese male college students*. *Public Health Nutr.*, 13, pp. 1575-1580.
- [12] Hurst Y., Fukuda H. (2018). *Effects of changes in eating speed on obesity in patients with diabetes: A secondary analysis of longitudinal health check-up data*. *BMJ Open*, 8. DOI:10.1136/bmjopen-2017-019589. Accessed 23 June 2023.
- [13] Kito K., Kuriyama A., Takahashi Y., Nakayama T. (2019). *Impacts of skipping breakfast and late dinner on the incidence of being overweight: A 3-year retrospective cohort study of men aged 20-49 years*. *J. Hum. Nutr. Diet.*, 32, (3), pp. 349-355.
- [14] Smith K. J., Gall S. L., McNaughton S. A., Cleland V. J., Otahal P., Dwyer T., Venn A. J. (2017). *Lifestyle behaviors associated with 5-year weight gain in a prospective cohort of Australian adults aged 26-36 years at baseline*. *BMC Public Health*, 17. DOI:10.1186/s12889-016-3931-y. Accessed 23 June 2023.
- [15] Nooyens A. C. J., Visscher T. L. S., Schuit A. J., van Rossum M. Y. C., Verschuren M. W. M., van Mechelen W., Seidell C. J. (2005). *Effects of retirement on lifestyle in relation to changes in weight and waist circumference in Dutch men: A prospective study*. *Public Health Nutrition* 8 (8), pp. 1266-1274.
- [16] Guinter M. A., Park Y. M., Steck S. E., Sandler D. P. (2020).

Day-to-day regularity in breakfast consumption is associated with weight status in a prospective cohort of women. Int. J. Obes., 44, pp. 186-194.

- [17] Odegaard A. O., Jacobs D. R., Steffen L. M., Van Horn L., Ludwig D. S., Pereira M. A. (2013). *Breakfast Frequency and Development of Metabolic Risk.* Diabetes Care, 36, pp. 3100-3106.
- [18] Kahleova H., Lloren J. I., Mashchak A., Hill M., Fraser G. E. (2017). *Meal frequency and timing are associated with changes in body mass index in Adventist health study 2.* J. Nutr., 147, pp. 1722-1728.
- [19] Van der Heijden A. A., Hu F. B., Rimm E. B., van Dam R. M. (2007). *A prospective study of breakfast consumption and weight gain among U.S. men.* Obesity, 15, pp. 2463-2469.
- [20] Jakubowicz D., Barnea M., Wainstein J., Froy O. (2013). *High Caloric intake at breakfast vs. dinner differentially influences weight loss of overweight and obese women.* Obesity, 21, pp. 2504-2512.
- [21] Ham E., Kim H. J. (2014). *Evaluation of fruit intake and its relation to body mass index of adolescents.* Clin. Nutr. Res., 3, (2), pp. 126-133.
- [22] Van Duyn M. A., Pivonka E. (2000). *Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: Selected literature.* J. Am. Diet. Assoc., 100, pp. 1511-1521.