THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, OVERWEIGHTNESS AND OBESITY IN ADULTS

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Abstract

Study aim. Evaluating the relationship between recreational and commuting physical activity and the occurrence of overweightness as well as obesity in adults.

Material and methods. An interview questionnaire was used to assess physical activity, and measurements of somatic features made it possible to calculate BMI (Body Mass Index), WHR (Waist-Hip Ratio) and WHtR (Waist-to-Height Ratio) indices used to assess overweightness and obesity. In total, 1,032 individuals were examined, including 517 women and 515 men aged 20-60, working at various facilities in the Świętokrzyskie Voivodeship. Basic numerical data and percentages were used in calculations, and Spearman’s rank correlation coefficients and Pearson’s non-parametric Chi-squared test ($\chi^2$) were applied to assess the correlations between variables.

Results. It was observed that in a group of people who are characterized by high recreational or daily commuting activity, a much lower percentage is overweight or obese. However, in people who are overweight and obese, the percentage of both women and men characterized by high and moderate physical activity decreases significantly, while the percentage of low recreational activity or no commuting activity increases.

Conclusions. This research clearly indicates that in the prevention of overweightness and obesity among adults, not only recreational activity undertaken during one’s leisure time, but also commuting activity related to walking or cycling to and from work, play an important role.

Introduction

It was already at the end of the previous century that obesity had been classified as a global epidemic, the occurrence of which is a complex phenomenon as it is conditioned by many factors, genetic, metabolic and environmental at the same time. According to WHO (World Health Organization) experts [1,2], the main causes of this global epidemic are primarily two factors: sedentary lifestyle and poor diet, especially the consumption of high fat and high-caloric foods, caused by changes in social patterns of human health behaviours [1,2].

Currently, it is estimated that approximately 10-25% of men and 10-30% of women in Europe are overweight or obese, and the total number of people with obesity reached 150 million while the incidence of this disease is constantly increasing [3]. It seems that the only reasonable behaviour that can reduce this tendency is a change...
in lifestyle [4-8], which involves altering the way of eating and increasing physical activity [9-11].

It is estimated that a person leading a sedentary lifestyle expends about 300 kcal per day, while consuming meals with approximately 2,100 kcal per day, which gives the ratio of 1:7 [5, 7, 12]. According to the recommendations of various specialists, a sufficient amount of physical activity that would enable improvement of these proportions and contribute to weight reduction regards aerobic efforts performed for 45-60 minutes or covering a distance of over 10 km per day on foot [4-8]. At the same time, the health benefits are determined by the values of total physical activity, without any division into occupational, recreational or commute-related. However, the results of many studies indicate that today's physically active lifestyle is shared only by a small proportion of adult Poles [13-15].

The assessment of physical activity of adults should take its type, scope and intensity into account. This can be assessed both subjectively and objectively [16], which in population studies, poses many difficulties and is practically often unfeasible. Therefore, various types of questionnaires are most frequently used in this type of research [17-19]. On the other hand, the BMI index is most frequently used for assessment of overweightness and obesity, allowing to evaluate simple obesity, resulting from excess body mass. However, it seems that the main purpose of this index is connecting the value of measurements for larger communities with the incidence of various types of lifestyle diseases [20], and various elements of the lifestyle, especially with physical activity.

A good complement to BMI (Body Mass Index) are WHR (Waist-Hip Ratio) and WHtR (Waist-to-Height Ratio) indices, which are associated with various and relatively constant obesity complications that are used to determine its type, i.e. android (abdominal obesity, "apple"), gynoidal (buttocks-thigh) or generalized (normal values) [21]. "Apple"-type obesity is located in the abdominal region and is associated with a higher risk of concurrent diseases, such as: arterial hypertension, type 2 diabetes or coronary heart disease [22]. It mainly concerns men, although menopausal women are also at risk. "Pear"-like obesity primarily occurs in women and causes excess fat located in the area of the buttocks and hips.

Low physical activity and sedentary lifestyle are the main risk factors for developing obesity, which is the cause of many serious diseases that can lead to premature death [3,23], and the cost of health care for overweight or obese people is almost 45% higher than in individuals with normal body mass [24]. Therefore, the main goal of the study was to assess the relationship between overweightness, obesity and physical activity, both recreational and leisure time, as well as commuting activity of adults residing in the Świętokrzyskie Voivodeship.

Material and methods

The research was carried out at various workplaces in the Świętokrzyskie Voivodeship, with the use of purposeful-random selection. In total, 1,032 subjects were included in the study, including 517 women and 515 men aged 20-60, using two research methods in this regard, namely interview and observation. The interview questionnaire contained questions about preferences related to the lifestyle, and its validation showed that the reliability coefficient (Cronbach's alpha) is 0.81, which qualifies it for use in cross-sectional studies [25]. Taking various international recommendations into account [10,16,26,27], 3 groups of recreational physical activity were distinguished (high – for a minimum of 30 minutes a day, 4 to 7 days a week; moderate – 1 to 3 days a week; low – 0 days a week), and 3 commuting activity groups (high – a minimum of 60 minutes a day, 4 to 7 days a week; moderate – 1 to 3 days a week and no commuting activity – 0 days a week).

Three indices were calculated on the basis of anthropometric measurements of basic somatic features:

- Body Mass Index (BMI), according to the formula: body mass in kg / body height in m².
- WHR (waist-hip ratio) – waist circumference / hip circumference in cm, which determines the distribution of body fat, and is used, and two tests were applied to determine relationships between variables: Spearman’s rank correlation coefficient and the non-parametric Chi-squared test (χ²) [25]. All calculations were performed using the STATIS-TICA 8.0 programme, and significance was determined at the level of p ≤ 0.05.

Results

The research results indicate that people who are not overweight or obese are characterized by high and moderate recreational activity (Fig. 1). On the other hand, individuals who are overweight or are characterized by...
simple obesity are the most numerous group among people who prefer passive rest, that is, low recreational physical activity or its complete lack.

The WHR classification shows that by far, the largest number of people with abdominal obesity is in the group characterized by low physical activity (45.1%), and the least is in the group with average recreational activity (27%) (Fig. 2). Most people without abdominal obesity are within the group characterized by moderate (73.0%) and high recreational activity (70.4%). On the other hand, the group of people preferring a sedentary lifestyle, i.e. low recreational activity, is the least diverse in this respect, because similar percentages of people have generalized as well as abdominal obesity (Fig. 2).

Along with the emergence of android obesity, the percentage of adults with low physical activity (61.9%) increased, while the least was in the group of people preferring moderate and high recreational activity (50.7%) (Fig. 3). The highest percentage of people with normal values of the WHtR index can be observed in the group of people showing moderate and high physical activity in their free time (49.3%), while the lowest number of people is in the group characterized by a sedentary lifestyle (38.1%). (Fig. 3).
Considering the number of days per week during which the subjects commuted on foot for over 60 minutes a day or by bicycle, it can be noticed that the group with the highest commuting activity is the least overweight and obese (Fig. 4). On the other hand, the majority of overweight (48.3%) and obese (13.2%) individuals are in the group of people who do not walk to work or who do not commute by bicycle (Fig. 4).

Generalized obesity (normal WHtR values) was most frequently observed in the group of the most active walkers (64.9%), along onto the group of moderately active people (1-3 times a week) (62.0%), and the least active (50%) (Fig. 5). Exactly the opposite was the case for people with abdominal obesity; the highest number of such people was observed in the group that does not walk to work or commute by bicycle (50%), and the smallest percentage of these people was found in the group walking or regularly commuting to work (35.1%) (Fig. 5).

Even more pronounced differences in the incidence of abdominal obesity are evident in relation to WHtR and commuting activity (Fig. 6), because most often, this type of obesity occurs among people who do not perform any of these forms of physical activity related to walking to or from work or commuting by bicycle.
The relationship between physical activity, overweightness...

Figure 5. WHR classification in adults characterized by different levels of commuting activity (%)

Figure 6. WHtR classification in adults characterized by different levels of commuting activity (%)

Table 1. Chi-square independence test results regarding the correlations between recreational physical activity and commuting activity in overweight and obese adults, determined by means of various indicators

<table>
<thead>
<tr>
<th>Index</th>
<th>Recreational physical activity</th>
<th>Commuting activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2$</td>
<td>df</td>
</tr>
<tr>
<td>BMI</td>
<td>15.848</td>
<td>6</td>
</tr>
<tr>
<td>WHR</td>
<td>28.152</td>
<td>2</td>
</tr>
<tr>
<td>WHtR</td>
<td>4.547</td>
<td>2</td>
</tr>
</tbody>
</table>

Statistically significant correlations in bold (REF Tab. 2-3)
The results of the Chi-squared test showed a significant relationship between both recreational physical activity and commuting activity, with almost all of the analysed overweightness and obesity indices observed in the subjects examined here. This correlation was only not observed in relation to physical activity in free time and the occurrence of abdominal obesity, assessed on the basis of the WHtR index (Tab. 1).

Furthermore, Spearman’s rank correlation coefficients indicate a statistically significant relationship between both recreational and commuting activity with the occurrence of various manifestations of overweightness and obesity in adults. At the same time, these are statistically significant, positive correlations, which means that along with the increase in both recreational and commuting activity, the number of people not overweight or obese is increasing (Tab. 2).

**Discussion**

When comparing the physical activity of different populations, both conceptual and terminological differences as well as various indications and recommendations regarding physical activity are a significant problem. Nevertheless, the authors of these studies clearly indicate that apart from a balanced diet, regular physical activity of moderate intensity [30,31,32] plays a significant role in maintaining proper body mass within the norm. Garber et al. [26,33] emphasize that the total of physical activity should be at least 200 kilocalories per day, hence, every adult person should accumulate 30 minutes or more of moderate physical activity, preferably every day of the week.

The well-known relationship between the development of structure and the improvement of functions allows to expect a clear correlation between the build and composition of the human body and its efficiency or physical activity. Hence, in the area of physical fitness, the influence of body build, determined on the basis of body mass (BMI) and fat tissue distribution indices (WHR and WHtR), for which its increased value has a generally negative connotation, is clearly highlighted (20,28,29,36,37]. It should be emphasized that the relationship between physical activity and overweightness as well as obesity, determined by means of these indices, seem to be based on the positive feedback mechanism. This means that physical activity affects the change in body composition, fat distribution, etc., characteristics that define overweightness and obesity, but also achieving the desirable values of these characteristics requires systematic physical activity [8,38].

It should be borne in mind that the recommended daily 30 min of physical activity can be totalled from the parts shorter in duration. Thus, of importance is not so much the intensity as the volume, and therefore, the overall energy expenditure of the body. It can include physical activity of a daily activity, such as walking up stairs – instead of using a lift, an intense walk – instead of driving a short distance, riding a stationary bicycle while watching TV, gardening, housework, dancing, etc. The intensity of these efforts must, however, be similar to a vigorous march. Therefore, people undertaking

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**Table 2.** Spearman’s rank correlation coefficients regarding relationships between recreational physical activity and commuting activity in overweight and obese adults, determined by means of various indices

<table>
<thead>
<tr>
<th>Index</th>
<th>Physical recreational activity</th>
<th>Commuting activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>t</td>
</tr>
<tr>
<td>BMI</td>
<td>0.09</td>
<td>2.7397</td>
</tr>
<tr>
<td>WHR</td>
<td>0.16</td>
<td>5.1553</td>
</tr>
<tr>
<td>WHtR</td>
<td>0.07</td>
<td>2.0410</td>
</tr>
</tbody>
</table>
such physical activity should perform these tasks more frequently and for as long as possible [10, 16], because today, the number of occupations and types of work requiring greater physical effort is declining [39].

Conclusions

1. Greater recreational physical activity as well as commuting activity of adults, which is often underestimated, shows a strong relationship with lower average values of almost all body build indices (BMI, WHR, WHtR) used to assess overweightness and obesity.

2. Along with the increase of both recreational and commuting physical activity, the percentage of adult women and men who have proper waist circumference increases, and the percentage with abdominal obesity is decreasing. However, spending free time in a passive way, or also not undertaking any commuting activity, is associated with an increase in abdominal obesity.

3. The conducted research clearly indicates that in the prevention of overweightness and obesity among adults, a significant role is played not only recreational but also commuting activity related to daily walking to and from work or commuting by bicycle.

References:


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