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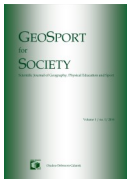


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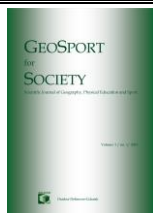
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Application of Water Quality Index in Assessment of Swimming Pools Water Quality in Hotels in Emerging Africa Littoral Metropolis of Warri, Delta State, Nigeria

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Abstract: Swimming pools in guest houses and hotels in many cities in sub-Saharan Africa have been labelled 'beautiful irritation' or hazard zones for public health issues due to the unwholesomeness of water. Pollution in swimming pools is therefore, not uncommon and it is a serious public health issue both at the global, regional, national and local levels. This study focused on application of water quality index in assessment of swimming pools water quality in hotels in emerging Africa littoral metropolis of Warri, Delta State, Nigeria. It used stratified random sampling technique to select five hotels with swimming pool in Warri for assessment. Temperature, pH, turbidity, free (residual) chlorine, total heterotrophic bacteria, total heterotrophic fungi, Escherichia coli and Staphylococcus aureus tested in the laboratory using scientific method of sampling. Water quality index (WQI) was computed using Weighted Arithmetic Water Quality Index (WAWQI) to evaluate in general, the quality of water in each of the five sampled swimming pools. A five-point scale (excellent, good, poor, very poor and unsuitable) was used to rank each swimming pool quality. Result showed that Wellington Hotel had the value of 2.52 and considered excellent in terms of water quality index value. Also, Brook View and Best Western Plus Hotels were classified as good water based on water quality index values of 36.9 and 39.9 respectively while BB swimming pool was ranked poor due to water quality index of 51.4. In contrast, Oasis Place Hotel swimming pool was declared unsuitable for recreational purpose due to a water quality index of 102.1. The study recommended routine and periodic surveillance of swimming pools and other recreational water sources to guarantee optimum health and wellbeing of users.

Keywords: Water quality, index, swimming pool, hotels, Warri Metropolis

Introduction

It is an established fact that water has several utilitarian values such as for recreation, drinking, fisheries, agriculture and industry. Water – based recreation is of vital importance to human life and the mortality rate is two times higher among non-swimmers than active swimmers (Chase et al., 2008; Anciaes et al., 2020). It is always enjoyable when compared with non-water related adventures (Lotshaw et al., 2007; Barnett et al., 2018) and critical antidotes for several persistent ailments including arthritis through enhance utilization of affected bodily parts devoid of aggravating pains (Westby, 2001; Stott, 2019). In spite of its usefulness, recreational water bodies in general and swimming pool in particular, are always vulnerable to various forms of pollutants. Polluted water is not healthy for drinking, bathing, industry, agriculture (United Nations-Water, 2014; Boelee et al., 2019) not to talk of its fitness for swimming and other recreational activities. Guest house and hotel pools, however, are oftentimes labelled ‘beautiful irritation’ or hazards. Pollution in swimming pools is not uncommon and it is a serious public health issue both at the global, regional, national and local levels.

Swimming pool has been described as a container filled with water intended for swimming or water-based recreation. It can be constructed either above or in the ground, using concrete materials (Eze et al., 2015; Godfrey, 2019). Swimming pools designated for public use are called public pools while private pools are those used exclusively by a few people or in homes. Hot tubs and spas are pools with hot water, used for leisure or rehabilitation and are common in homes, hotels, clubs and massage parlours (Eze et al., 2015). Tourism and hospitality practitioners, fitness centers, health clubs and private clubs often incorporate swimming pools into their businesses as value – added services to capture customers’ interest, boost patronage and quick returns for investment.

Empirical evidence show that about 20% swimmers urinate in swimming pools, 23% of users are worried about the hygiene and sanitation status of the public pools while about 35% of swimmers do not bath before jumping into the pool (Agbagwa and Young-Harry, 2012). Majority of swimmers contaminate pool water with large amounts of microorganisms as a result of various secretions from skins, mouths, noses and throats, urines or by contaminated objects and clothes, making water a possible vehicle for the dissemination of infectious diseases among swimmers (Dirtu et al., 2016). From the skin alone uncountable bacteria are rinsed during swimming and if the water is untreated, these microorganisms will build up and increase the chance of transmission to swimmers (Rabi et al., 2008; Bonadonna and La Rosa, 2019).

Swimming pool contamination can also come from pets especially dogs that occasionally wander around unprotected pools as well as from debris already around the properties. It could also be as result of the direct animal contamination including flying birds (Pesewu et al., 2015). It is therefore, essential to be able to evaluate the risks associated with a pool. The risks associated with pool drowning, impact injuries, physiological, infection and poisoning, toxicities and other conditions that may arise from long-term chemical exposures, contact with, inhalation or ingestion of algal toxins (Eze et al., 2015). In Nigeria and many other

countries in sub-Saharan Africa, statistics on water quality of swimming pools are lacking. A lot of attention is given to surface and groundwater quality for drinking purpose by most researchers (Aghoghovwia, 2011; Fovwe et al., 2014; Asadu, 2016).

Currently, there is no data about infections and outbreak of diseases related to swimming pools in hotels in emerging African littoral metropolis of Warri, Delta State, Nigeria. The strategic importance of Warri in the economy of Nigeria as one of the oil producing metropolis and as a destination to many tourists, fun and pleasure seekers as well as investors around the world should have motivated researchers to explore water quality in swimming pools. Stakeholders also appear to ignorantly believe that all is well in Warri in terms of water quality in swimming pools. Compliance, governance and regulatory frameworks concerning the business and operation of swimming pools in the metropolis may also unable to meet with the emerging challenges of water quality. Public health, good sanitation and personal hygiene practices are other challenging issues surrounding water quality in swimming pools.

Saba and Tekpor (2015) reported that those who normally take care of these swimming pools have little knowledge about the importance of maintaining the pools to meet both the microbiological and physiochemical standards. Some operators may be tempted to economize chemicals used for sanitizing the pools as a result of their scarcity or perhaps over-chlorinate the pools due to little knowledge of the recommended quantities to apply and hence compromise the quality of the swimming pools (Saba and Tekpor, 2015). All these issues have unquantifiable consequences and impact to sustainable users' welfare and tourism development. Thus, it is not a simple thing to say "that water is good" or "that water is bad." The determination of water quality is typically made relative to the purpose of the water – in this case for recreational (swimming pool).

There are a number of physical, chemical, and biological indicators that are most commonly used in assessing the quality of water in swimming pools. The physical indicators include temperature, total suspended solids (TSS), total dissolved solids (TDS), electrical conductivity, and turbidity. Chemical indicators include pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), chlorine and total hardness (TH). The biological indicators are total coliform count (TCC), faecal coliform count (FCC) and other pathogenic bacteria and algae. The assessment of these parameters is capable of establishing and tracking alterations in water quality while verifying its suitability for the wellbeing of recreational users and one of the emerging frameworks uses is water quality index.

However, water quality index (WQI) has often been misconstrued to mean water quality standards (WQSs). Although both are concepts used in water quality monitoring and assessment, they are fundamentally different. Water quality index has therefore been seen as priceless and matchless evaluation set up to depict the overall water quality status in a single term that is helpful for the selection of right management modus operandi to meet the concerned issues (Tyagi et al., 2013). Conversely, water quality standards are governance frameworks covering specific

uses and water quality criteria to save uses from gratuitous harm (United States Environmental Protection Agency - USEPA, 2016).

The decisive factor espoused and integrated into the standards are the tolerable concentration of pollutants in states, territories and certified clannish waters. The environmental watch dog argued that these norms are corresponding: each is premeditated to save users from harm from particular specie of micro organisms or environmental systems from the unpleasant outcome of contamination. Water quality norms are formulated autonomously based on the best available scientific data and scientific judgments. The criteria are generally listed at some threshold concentration that, if exceeded, would cause harm to aquatic life, wildlife or human health (USEPA, 2016). Thus, while water quality index portrays the combined influence of diverse water quality indicators and conveys water quality issues to the public and legislative decision makers (Tyagi et al., 2013), water quality standards depicts the scientifically established targets approved by regulatory agencies for different water uses (World Health Organization - WHO, 2018).

Till date, there is also no globally accepted composite index of water quality; several countries have only resulted to using aggregated water quality data in the development of water quality indices (Banda and Kumarasamy, 2020). For water quality standards, there are a number of them including the World Health Organization (WHO), Australia, Brazil, Canada, India, Tanzania, the United States, the Federal Environmental Protection Agency (FEPA), Standard Organization of Nigeria and Department of Petroleum Resources standards amongst others. Table 1 shows the WHO water quality standards for selected parameters in relation to safe recreational water environments.

Table 1. WHO Standards for Swimming Pools and Similar Environments

Source: WHO (2006)

| Parameters | Maximum Allowable Limit |
|---------------------------------|-------------------------------------|
| Temperature | 26 ^o - 30 ^o C |
| Turbidity | ≤ 0.5 NTU |
| pH | 7.2 - 7.8 |
| Free residual chlorine | 1 - 3 mg/l |
| Heterotrophic plate count (HPC) | ≤ 200 cfu/ml |
| <i>Escherichia coli</i> | ≤ 1/100 ml |
| <i>Staphylococcus aureus</i> | ≤ 100/100 ml |

According to the Department of Environment and Climate Change (DECC), Government of Newfoundland and Labrador (2016), a water quality index is a means by which water quality data is summarized for reporting to the public in a consistent manner. Empirical evidence point to the fact that water quality index is accredited to the work of Horton (1965) among the most commonly used water quality variables include dissolved oxygen (DO), pH, coliforms, specific conductance, alkalinity and chloride etc. and has been widely applied and accepted in European, African and Asian countries (Chandra et al., 2017). In the computation of water quality index, a stepwise procedure which relies on indicators of public health importance has been proposed. The initial step involves the choice of water quality

indicators. This is the exclusive responsibility of water quality governance authorities and its resource persons and within its jurisdiction. At this step, specific emphasis is given to the concentrations of DO, healthiness implications, physicochemical features as well as suspended mineral salts capable of interfering with the biological activities in the water source (Dunnette, 1979; Scannone, 2016).

The second step entails the establishment of functional relationship among indicators and statistical normalization of all indicators into unitless scale (Fritzsche et al., 2014). The rationale for statistical normalization of all indicators is based on the fact that various water quality indicators are measure on specific scientific unit that is entirely different from others. The final step involves the summing together of all water quality indicators to arrive at a single value otherwise referred to as index (Garcia et al., 2018).

In practice, the water quality index is calculated by comparing the water quality data to established guidelines for water quality. Water quality index measures the scope, frequency, and fluctuations in the level of water quality and then combines the three measures into one score. This calculation produces a score between 0 and 100. The higher the score, the better the quality of water and the scores are then ranked into one of the five categories (DECC, 2016). The index is a valuable and unique rating to depict the overall water quality status in a single term that is helpful for the selection of appropriate treatment technique to meet the concerned issues. Nevertheless, several water quality indices have been have been postulated by a number of national and international organizations and documented in contemporary literature. Most popular ones include the Weighted Arithmetic Water Quality Index (WAWQI), National Sanitation Foundation Water Quality Index (NSFWQI), Canadian Council of Ministers of the Environment Water Quality Index (CCMEWQI), and Oregon Water Quality Index (OWQI) among others. Moreover, water quality indices have been known to vary from season to season even at low concentrations (Kachroud et al., 2019).

The Weighted Arithmetic Water Quality Index (WAWQI) method originally developed by Brown et al., (1972) categorizes the water quality according to the extent of cleanness taking into consideration`n the generally frequently considered indicators using the formula in equation 1.

$$WQI = \sum QiWi / \sum Wi \quad (1)$$

The quality evaluation scale (Qi) for each indicator is computed with the function in equation 2:

$$Q = 100[(Vi - Vo / Si - Vo)] \quad (2)$$

Where,

Vi is approximate level of i th indicator from laboratory analysis

Vo is the real value of this indicator in uncontaminated sample

$Vo = 0$ (except pH =7.0 and DO = 14.6 mg/l)

Si = allowable limit of i th indicator.

The respective weight (W_i) for each indicator is computed with the function in equation 3:

$$W_i = K / S_i \tag{3}$$

Where K = mathematical constant and is computed with the function in equation 4:

$$K = \frac{1}{\sum(1/S_i)} \tag{4}$$

The computed water quality index value is then evaluated according the category which it falls as presented in Table 2. Remarkably, the advantage and disadvantages of WAWQI framework has been documented as summarized in Table 3. The major underlying principle for evolution water quality index is pivoted by transforming multifarious indicators of water quality into well-articulated, clear, simple and credulous information of the water source to all users (Akoteyon et al., 2011; Balan et al., 2012; Bora and Goswami, 2016).

Table 2. Water Quality Rating Based on WAWQI Method
Source: (Brown et al., 1972)

| WQI Value | Evaluation of Water Quality | Category |
|-----------|---------------------------------|----------|
| 0-25 | Excellent water quality | A |
| 26-50 | Good water quality | B |
| 51-75 | Poor water quality | C |
| 76-100 | Very Poor water quality | D |
| Above 100 | Unsuitable for drinking purpose | E |

Table 3. Advantages and Disadvantages of WAWQI Framework
Source: (Yogendra and Puttaiah, 2008; Akoteyon et al., 2011; Tyagi et al., 2013)

| Advantages | Disadvantages |
|---|--|
| <ol style="list-style-type: none"> 1. Incorporate data from multiple water quality parameters into a mathematical equation that rates the health of water body with number. 2. Less number of parameters required in comparison to all water quality parameters for particular use. 3. Useful for communication of overall water quality information to the concerned citizens and policy makers. 4. Reflects the composite influence of different parameters i.e. important for the assessment and management of water quality. 5. Describes the suitability of both surface and groundwater sources for human consumption. | <ol style="list-style-type: none"> 1. Water quality index may not carry enough information about the real quality situation of the water. 2. Many uses of water quality data cannot be met with an index. 3. The eclipsing or over-emphasizing of a single bad parameter value 4. A single number cannot tell the whole story of water quality; there are many other water quality parameters that are not included in the index. 5. Water quality index based on some very important parameters can provide a simple indicator of water quality. |

Unfortunately, drinking water quality in Nigeria and other developing countries is questionable not to talk about that of recreational water facilities like swimming pools. This aspect of research has not enjoyed considerable patronage until in recent years. Again, despite the advantages of the approach, empirical evidence on application of water quality index in swimming pools water quality

assessment in hotels in emerging African littoral metropolis of Warri, Delta State is lacking. Whereas, water quality index framework have been applied in both surface and groundwater quality assessment all around the world since the last few decades (Kumar and Dua, 2009; Rocha et al., 2015; Bora and Goswami, 2016; Egun and Ogiesoba-Eguakun, 2018; Soleimani et al., 2018).

Based on the significant role played by recreational water activities to health and vitality in general, and the key value of swimming pools to the hospitality and tourism industry, the need to fill these knowledge gaps becomes essential. The study therefore, seeks to analyze the water quality of hotels swimming pools in emerging African littoral metropolis of Warri, Delta State to using water quality index with the view to establish the extent of contamination. The application of water quality index in this study will provide an easy way to understand the status of water quality in swimming pools in Warri and the information will be useful to the public in general, pool operators, planners, managers, and policy makers.

Methodology

Geography of Warri Metropolis

This study was carried out in one of the emerging African littoral metropolis of Warri, Delta State, Nigeria. Warri metropolis is spatially situated between latitudes 50 27' 50.468" – 50 36' 39.937" North of Equator and longitudes 50 42' 34.5" – 70 49' 44.431" East of Greenwich as seen in Figure 1. Warri metropolis has constituent parts in Warri South, Udu and Uvwie Local Government Areas. It has also grown to engulf the surrounding towns of Effurun, Ekpan, Enerhen, Orhuwhorun, Ogunu, Jakpa, Ovwian-Aladja and Ugbomro in the last few decades (Efe and Efe, 2002). Warri is one of the rapidly growing metropolis in Nigeria, with the population increasing rapidly from 280,000 in 1980 to 363,382 in 1991, 536,023 in 2006 and subsequently to 814,000 at the end of 2019 (Macrotrends LLC, 2019). Warri thus, has a high population density, concentrated in the areas of the city, including Warri-Sapele road, Agbassa, Okere, Okumagba Avenue, Igbudu, Iyara, Jakpa, Airport road, Petroleum Training Institute (PTI), Udu and Ekpan.

The climate of Warri metropolis falls within the tropical rainforest with frequent influence of tropical continental and maritime air masses. The high-resolution time-series (TS) gridded climatic data of month-by-month variation in climate (version 4.03 - January 1901 - December 2018) released by the University of East Anglia-Climatic Research Unit, Harris and Jones (2019) indicate that temperature is as low as 22.1°C in January and as high as 33.6°C in February in Warri metropolis. Rainfall pattern is bi-modal with the first peak of 507.8 mm in June with a short dry season in August and the second peak of 493.1 mm in September and a total about 3745.7 mm per annum. Relative humidity is generally high due to abundance of rainfall and it ranged from 94% in April to 97% in August with a dry season average of about 80%. Annual potential evapotranspiration is about 57.1 mm with highest value of 5.8 mm observed in February and lowest value of 3.5 mm noticed in July. Mean wind speed is about 2.3 meters per second and may sometime exceed 5 meters per second in peak rainy season.

With respect to the relief, Warri metropolis is generally a low-lying area which situate within the Niger – Delta plain. Digital elevation model (DEM) is a representation of the general relief of the area. DEM represent continuous elevation values over a topographic surface by a regular array of z-values, referenced to a common datum. DEMs are typically used to represent terrain relief. Average elevation is about 10.1 meters and ranged from 2 meters to 29 meters above sea level.

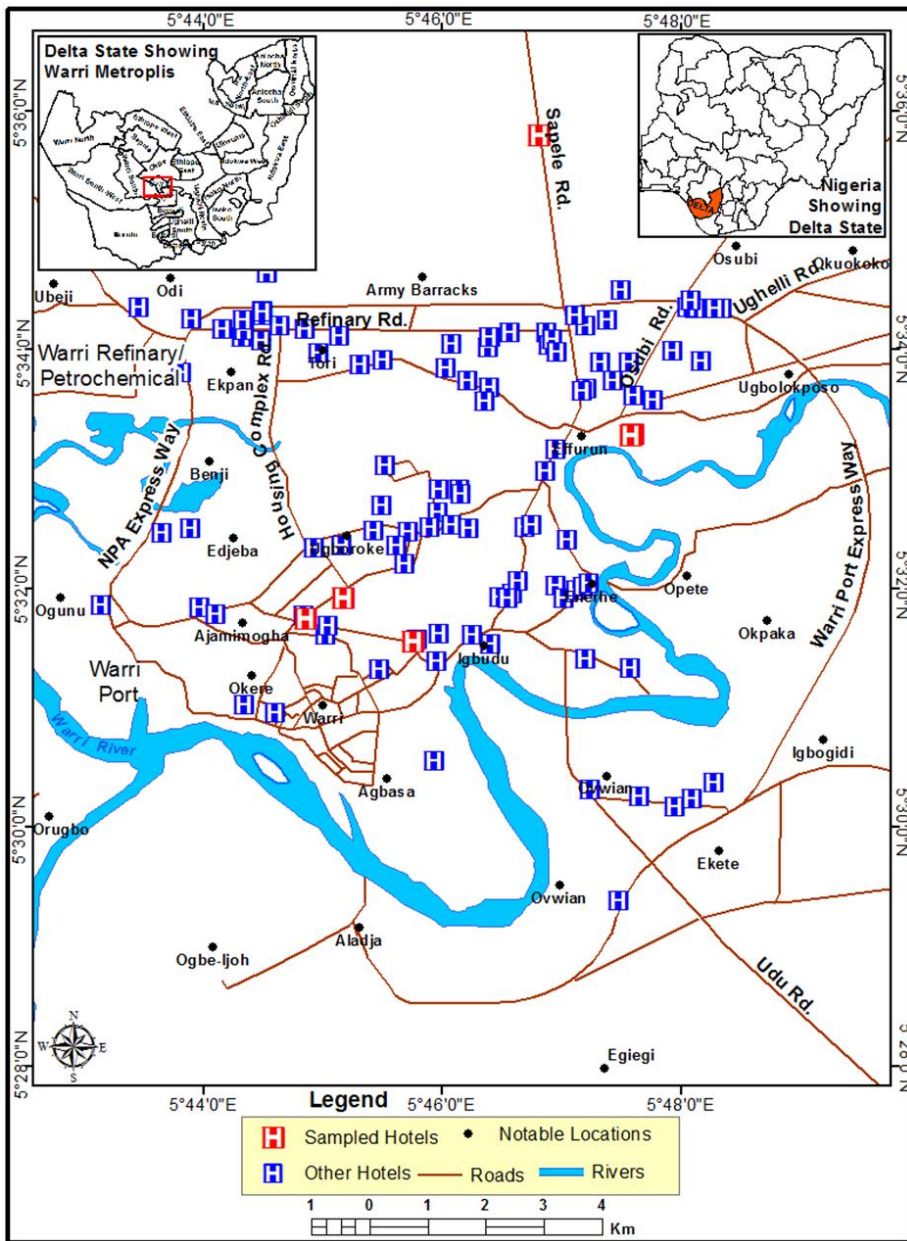


Figure 1. Warri Metropolis Showing Sample Hotels with Swimming Pools

Vegetation in Warri metropolis is characteristic fresh water intermingled with mangrove swamp forest which represents the most luxuriant, complex and diverse terrestrial ecosystem in sub-Saharan Africa. The socio-economic activities in Warri metropolis can be classified into primary, secondary and tertiary activities. The primary activities include agricultural activities and animal husbandry. Secondary activities include several manufacturing and processing activities carried out by firms and oil companies in the metropolis while tertiary activities include activities and services carried out by servicing firms and individuals. Warri metropolis is also an administrative centre, with the headquarters of Warri South LGA, Udu and Uvwie LGA located in it.

Datasets, Sources, Methods of Analyses

This research adopted experimental approach to elucidate information on swimming pool water quality in Warri metropolis. The physical properties of swimming pool water that were investigated include temperature and turbidity. Free (residual) chlorine and pH constituted the chemical parameters while total heterotrophic bacteria (THB), total heterotrophic fungi (THF), *Escherichia coli* and *Staphylococcus aureus* made up the microbiological quality parameters. Based on the research objective, these variables were of particular importance to this study. As seen the literature, they are most relevant as far as public health and safety is concerned. According to Delta State Hotels and Tourism Board (DSHTB), there are 214 hotels in Warri based on 2016 records. Out of this figure, 15 of them have functional swimming pools (DSHTB, 2016) representing 7% of the hotels in the town. Stratified random sampling (Kaplan, 2014) based on room rate per night (Table 4) was deployed in selection of five hotels with swimming pools.

Table 4. Stratification of Hotels Based on Room Rate per Night
(Source: Fieldwork, 2019)

| S/No | Charges Interval per Night (₦) | Number of Hotels (Frequency) | Description |
|------|--------------------------------|---------------------------------|-------------|
| 1 | 1,000.00 – 5,000.00 | 4 | Very Low |
| 2 | 5,100.00 – 10,000.00 | 6 | Low |
| 3 | 10,100.00 – 15,000.00 | 4 | Moderate |
| 4 | 15,100.00 – 20,000.00 | 1 | High |
| 5 | 20,100.00 – 25,000.00 | 1 | Very High |
| | | N =16 | |

Standard procedures were adopted in water sample collection and laboratory analysis in line with the requirements specified by WHO, the American Society for Testing and Materials (ASTM), United States Environmental Protection Agency (USEPA) and American Public Health Association (APHA). The water was obtained from five sampled swimming pools from hotels in Warri metropolis for laboratory investigation during peak period (weekend). In-situ analyses were immediately carried out to determine the following parameters with short holding time; temperature, pH, turbidity, and Free (residual) chlorine. Water samples for microbiology analysis (THB, THF, *E. coli* and *S. aureus*) were collected in 200 ml

plastic containers, acidified with 10% HNO₃ stored in cooler at 4°C+0. 2°C and immediately transported to the laboratory for analysis using the techniques described in Esinulo and Ogbuagu (2016).

Computation of Water Quality Index (WQI) Swimming Pools

This study used Weighted Arithmetic Water Quality Index (WAWQI) method to compute water quality index of hotels' swimming pools water quality in Warri metropolis. Thus, with the aid of Equations 1 – 4 earlier stated the laboratory results of water quality indicators per sampled swimming pool were used as input in water quality index computation. However, this study adopted a bottom – up approach in the computation of water quality index through the following step:

Step 1: Determination of K for pH, temperature, turbidity and free (residual) chlorine using Equation 4.

$$pH = K = \frac{1}{\sum(1/7.8)} = \frac{1}{0.128} = 7.813$$

$$\text{Temperature} = K = \frac{1}{\sum(1/30)} = \frac{1}{0.033} = 30.303$$

$$\text{Turbidity} = K = \frac{1}{\sum(1/0.5)} = \frac{1}{2} = 0.5$$

$$\text{Free (residual) chlorine} = K = \frac{1}{\sum(1/0.5)} = \frac{1}{2} = 0.5$$

Step 2: Computation of the unit weight (W_i) for pH, temperature, turbidity and free (residual) chlorine using Equation 3.

$$pH = W_i = \frac{K}{S_i} = \frac{7.813}{7.8} = 1.002$$

$$\text{Temperature} = W_i = \frac{K}{S_i} = \frac{30.303}{30} = 1.0101$$

$$\text{Turbidity} = W_i = \frac{K}{S_i} = \frac{0.5}{0.5} = 1$$

$$\text{Chlorine} = W_i = \frac{K}{S_i} = \frac{3.03}{3} = 1.01$$

Step 3: Computation of the quality rating scale (Q_i) for each parameter in all the 5 sampled swimming pools using Equation 2.

Brook View Hotel

$$pH = Q_i = \left[\frac{V_i - V_o}{S_i - V_o} \right] 100 = \left[\frac{6.40 - 7.0}{7.8 - 7.0} \right] 100 = -75$$

$$\text{Temperature} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{25-0}{30-0} \right] 100 = 83.3$$

$$\text{Turbidity} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.63-0}{0.5-0} \right] 100 = 126$$

$$\text{Chlorine} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.4-0}{3-0} \right] 100 = 13.3$$

Oasis Hotel

$$pH = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{6.60-7.0}{7.8-7.0} \right] 100 = - 50$$

$$\text{Temperature} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{25-0}{30-0} \right] 100 = 83.3$$

$$\text{Turbidity} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{1.85-0}{0.5-0} \right] 100 = 370$$

$$\text{Chlorine} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.2-0}{3-0} \right] 100 = 6.67$$

BB Hotel

$$pH = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{6.20-7.0}{7.8-7.0} \right] 100 = - 100$$

$$\text{Temperature} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{25-0}{30-0} \right] 100 = 83.3$$

$$\text{Turbidity} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{1.08-0}{0.5-0} \right] 100 = 216$$

$$\text{Chlorine} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.2-0}{3-0} \right] 100 = 6.67$$

Wellington Hotel

$$pH = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{6.10-7.0}{7.8-7.0} \right] 100 = - 112.5$$

$$\text{Temperature} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{25-0}{30-0} \right] 100 = 83.3$$

$$\text{Turbidity} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.16-0}{0.5-0} \right] 100 = 32$$

$$\text{Chlorine} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.2-0}{3-0} \right] 100 = 6.67$$

Best Western Hotel

$$pH = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{6.30-7.0}{7.8-7.0} \right] 100 = - 87.5$$

$$\text{Temperature} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{29 - 0}{30 - 0} \right] 100 = 96.67$$

$$\text{Turbidity} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.72 - 0}{0.5 - 0} \right] 100 = 144$$

$$\text{Chlorine} = Qi = \left[\frac{Vi - Vo}{Si - Vo} \right] 100 = \left[\frac{0.2 - 0}{3 - 0} \right] 100 = 6.67$$

Step 4: Computation of the water quality index for all the five sampled swimming pools using Equation 1.

(a) Water quality index for Brook View Hotel Swimming Pool

$$\frac{(-75 \times 1.002) + (83.3 \times 1.0101) + (126 \times 1) + (13.3 \times 1.01)}{(1.002 + 1.0101 + 1 + 1.01)} = \frac{(-75.15) + (84.14) + (126) + (13.433)}{(4.0221)} = 36.9$$

(b) Water quality index for Oasis Hotel Swimming Pool

$$\frac{(-50 \times 1.002) + (83.3 \times 1.0101) + (370 \times 1) + (6.67 \times 1.01)}{(1.002 + 1.0101 + 1 + 1.01)} = \frac{(-50.1) + (84.14) + (370) + (6.74)}{(4.0221)} = 102.1$$

(c) WQI for BB Hotel Swimming Pool

$$\frac{(-100 \times 1.002) + (83.3 \times 1.0101) + (216 \times 1) + (6.67 \times 1.01)}{(1.002 + 1.0101 + 1 + 1.01)} = \frac{(-100.2) + (84.14) + (216) + (6.74)}{(4.0221)} = 51.4$$

(d) WQI for Wellington Hotel Swimming Pool

$$\frac{(-112 \times 1.002) + (83.3 \times 1.0101) + (32 \times 1) + (6.67 \times 1.01)}{(1.002 + 1.0101 + 1 + 1.01)} = \frac{(-112.73) + (84.14) + (32) + (6.74)}{(4.0221)} = 2.52$$

(e) WQI for Best Western Hotel Swimming Pool

$$\frac{(-87.5 \times 1.002) + (96.6 \times 1.0101) + (144 \times 1) + (6.67 \times 1.01)}{(1.002 + 1.0101 + 1 + 1.01)} = \frac{(-87.7) + (97.6) + (144) + (6.74)}{(4.0221)} = 39.9$$

This produced a score (value) ranging from 0 to 100. Using Table 2, each swimming pool was categorized based on quality. DECC (2016) however asserted that a higher score depicts poor water quality while a lower value is an indication of high water quality.

Results and Discussion

The computation of water quality index of five sampled hotels' swimming pools in emerging African littoral metropolis of Warri, Delta State, Nigeria was based on four physicochemical water quality parameters of pH, temperature, turbidity and chlorine. The microbiological indicators were not computed for since their

concentration was not observed in the water samples. Absence of microbiological indicators in all the sampled swimming pools in Warri metropolis is a pointer to high level of compliance stipulated by WHO (2006). Nevertheless, this finding contradicts earlier report by Osei-Adjei et al., (2014) where all the microbiological indicators in sampled swimming pools in Osu-Labadi, Accra, Ghana were above WHO (2006) standards. A related study of swimming pools in Shahrekord City, Iran also had microbiological indicators higher than acceptable limit set by regulatory authorities (Fadaei and Amiri, 2015). In contrast, the finding corroborates the finding of Amala and Aleru (2016) where *E. coli* and *S. aureus* were conspicuously not discovered in all 10 sampled swimming pools in Port Harcourt metropolis. The authors further argued that this level can only be maintained with routine screening to avert possible contamination.

Similarly, it was found that the mathematical constant (K) for pH was 7.813, temperature (30.303), turbidity (0.5) and free (residual) chlorine (0.5). Although empirical evidence on the use of water quality index in assessing swimming pool water quality is lacking for result synthesis, the K factor for pH found in this study was higher than the value reported by Soleimani et al., (2018) while evaluating water quality used for consumption and irrigation in Kurdistan, Iran. With respect to unit weight (Wi) pH was 1.002, temperature (1.0101), turbidity (1) and free (residual) chlorine (1.01). Regarding Qi in Brook View Hotel, pH was - 75, temperature (83.3), turbidity (126) and Chlorine (13.3). Oasis Hotel recorded Qi of - 50 for pH, temperature (83.3), turbidity (370) and Chlorine (6.67).

BB Hotel had Qi of -100 for pH, temperature (83.3), turbidity (216) and Chlorine (6.67). In Wellington Hotel recorded Qi of -112.5 for pH, temperature (83.3), turbidity (32) and Chlorine (6.67). Wellington Hotel resulted in Qi of -87.5 for pH, temperature (96.67), turbidity (144) and Chlorine (6.67). Again, the unit weight (Wi) for pH and turbidity discovered in this study was relatively higher than 0.322 for pH and 0.005 for turbidity report by Kumar and Dua (2009) while deploying water quality index in the evaluation of water quality of River Ravi, Madhopur, India. Also, Qi for free (residual) chlorine found in this work was higher than 0.105 reported by Rocha et al., (2015) while investigating the portability of water in Orós Reservoir (Northeast of Brazil) for drinking purpose.

The overall water quality index of the five sampled swimming pools as summarized in Table 5 showed that swimming pool located in Wellington Hotel had water quality index value of 2.52 and considered excellent in terms of water quality.

Table 5. Computed Water Quality Index of Sampled Hotels' Swimming Pools in Warri

Source: Fieldwork, 2019

| S/No | Sampled Hotel | WQI | Standard Value | Classification |
|------|-------------------|-------|----------------|-------------------------------------|
| 1. | Brook View | 36.9 | 26 - 50 | Good water quality |
| 2. | The Oasis Place | 102.1 | > 100 | Unsuitable for recreational purpose |
| 3. | BB Hotel | 51.4 | 51 - 75 | Poor water quality |
| 4. | Wellington Hotel | 2.52 | 0 - 25 | Excellent water quality |
| 5. | Best Western Plus | 39.9 | 26 - 50 | Good water quality |

Also, Brook View Hotel with water quality index of 36.9 and Best Western Plus with water quality index of 39.9 were categorized as good water quality. The excellent and good water quality observed in three out of the five sampled swimming pools may not be unconnected to the maintenance of high hygiene and sanitation standards by operators and swimmers. This implied that swimmers would have very little or no health hazard in any event of accidental swallowing of the swimming pool water. This finding corroborates with that of Egun and Ogiesoba-Eguakun (2018) who reported excellent water quality (9.17-10.40) between February-June 2016 in Okhuaihe River, Edo State, Nigeria.

On the contrary, poor water quality (51.4) was reported in swimming pool owned and operated by BB Hotel while the swimming pool in The Oasis Place Hotel was categorized unsuitable for recreational purpose based on the water quality index of 102.1. Similarly, poor water quality, which was believed to have been caused by noticeable coloration, turbidity and dissolved salts, had previously been reported at the upper course of Orós Reservoir (Rocha et al., 2015). Concerted efforts are therefore needed by operators of these hotels to work on measures to improve the quality of water in the swimming pools in order to meet with established standard and fit for recreational purposes.

Conclusion

The quality of recreational water in many Nigerian cities cannot be neglected because of the risk and implications to human health. The prime motivation for carrying out this study was deploy the ingenuity offered by water quality index framework to provide a distinct score to the water quality of swimming pools in hotels in Warri metropolis. Water quality index facilitated the transformation of several indicators and their concentration present in a sample into a single value. These water quality index scores consecutively provided far-reaching explanation of the quality of water and its suitability for recreational purposes. One swimming pool water quality was categorized excellent, two were graded good, one each was ranked poor and unsuitable for recreational purpose whereas. The categorization of water quality of hotels' swimming pools water quality in Warri metropolis was facilitated by the deployment of Weighted Arithmetic Water Quality Index (WAWQI) framework.

At first sight, potential tourist, fun seekers, policy makers and other stakeholders can know the status of each swimming through the water quality index scores. Operators and managements of individual hotel and swimming pool can also use the index in facility-based evaluation of the extent of success and/or failure recorded so far while also exploring opportunities for improvement and sustainable water quality maintenance. The study therefore recommends routine and periodic surveillance of swimming pools and other recreational water sources to guarantee optimum health and wellbeing of users. This can be achieved through massive enlightenment by appropriate media and regulatory authorities. Also, effective institutional arrangement and governance framework capable of handling issues related to policies, proper legislation, enforcement, right systems, etc. should be put place in Warri metropolis and other emerging cities in Nigeria.

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The Effect of Workplace Incentives with Regards to the Well-Being of the Employees

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Abstract: Nowadays, health is not only valued for the individual, but many jobs have recognized that a healthy workforce contributes to a company's productivity and reduces health care costs, meaning that the value of human resources is an important pillar of the competitiveness of businesses and organizations (Nyitrainé Garaj, 2015; Péter, 2018; Bácsné et al., 2017). The main focus of our research was to examine the effect of incentives used in workplace health promotion on the well-being of the employees and on promoting healthy lifestyle. The data for our primary research was collected via questionnaire. The survey has been designed to provide information about the lifestyle of the average Hungarian employees, the fringe benefits as the incentives of physical activity and their utilization. Beyond this we were interested in finding out if there should be an initiation on the employers' side regarding physical activity would there be an inclination within the employees for its usage. The result of the survey (N=133) shows that since white collar workers spend the majority of their days with little to no physical activity while working, sought out more sporting activities outside work. The data also suggest a health conscious behaviour among the respondents with high scoring driving factors for physical activity such as the importance of health, stress relief etc. Furthermore, results showed that after receiving these incentives employees engaged more frequently in sporting activities and that there is a willingness for use among those not receiving it.

Keywords: workplace health promotion, well-being, employee's well-being, healthy lifestyle

Introduction

In today's fast globalizing world where technological changes are constant the increasing need for effectiveness and comfortability outweighs the importance of physical activity. In addition, time spent with work is steadily growing. The number of working hours per week and the length of active working life have increased as well (Bokor, 2009). This change in lifestyle contributes significantly to the fast spreading of civilizational diseases. Because of this reason it is not surprising that

the determining factor of future's competitiveness is considered to be healthy labour (Nyitrainé Garaj, 2015; Szolnoki, 2013; Hegyesné Görgényi, 2019).

The contribution of a healthy workforce can be interpreted on different levels. On one hand healthy employee has a direct impact on its organisation by lowering the cost of healthcare. Indirectly, the improvement of the workers health, absenteeism or days spent in sick leave and incapacity to work can be significantly lowered, while productivity is notably increased (Kapás, 2007).

Besides the direct and indirect impact on organisational efficiency it is important to mention other additional benefits of the healthy human capital and well-being of the employees', such as its impact on recruitment, retention, work moral, fluctuation, loyalty and the reputation or image of the organisation (Kapás, 2007). In conclusion healthy labour is a remuneratory investment in the business sector (Balogh, 2018).

Taken these facts into consideration it is not surprising that workplace health promotion, aimed at the physical and mental wellbeing of the employees is shifting more and more into focus in recent years and that it gives an integral part of European Union 2014-2020 strategy. European Agency for Safety and Health at Work has therefore given high priority to the issue as well (Bögös, 2018).

It is also important to mention, that while the general view is that physical wellbeing is the sole responsibility of the people, because the contribution of the individual and because its increased significance on organisation level highlighted above the role of the employer on health promotion can't be overlooked (Balogh, 2018; Hegyesné Görgényi, 2018; Karoliny, 2016).

The main focus of our research was to examine the effect of incentives used in workplace health promotion on the well-being of the employees and on promoting healthy lifestyle. The survey has been designed to provide information about the lifestyle of the average Hungarian employees, the fringe benefits as the incentives of physical activity and their utilization. Beyond this we were interested in finding out if there should be an initiation on the employers' side regarding physical activity would there be an inclination within the employees for its usage.

We have chosen two of these incentives from Hungarian health promotion practices, namely the "Szép" Card and the All You Can Move Sport Pass (AYCM). Where the former is a Card system containing three "pockets" with different amount of money in each that can be used up for accommodations, holidays, catering or health and sporting purposes as well. While the latter serve - as its name suggests - as an ultimate Sport Pass that depending on the size of the package gives access of hundreds of sporting facilities country wide including yoga studios, swimming pools, gyms etc. to its owner.

Theoretical background

The positive effect of physical activity and exercise on health has already been proven (Lee et al., 2001; Biró, 2015; Hidvégi et al., 2017), but we can also find more and more research on individual sports and forms of movement. They analyze the effect of physical activity on the body, physical and mental health (Bond et al., 2002;

Pikó and Keresztes, 2007; Borbély and Müller, 2008; Bodolai et al., 2016), and also deal with their recreational role (Bendíková, 2017; Puskás et al., 2018; 2019).

Active lifestyle, regular sporting activities becoming lifestyle elements and encouraging it in all ages is an important task, as they play an important role in the prevention of lifestyle related diseases (stroke, cardiovascular diseases, stress and mental illness, obesity, osteoporosis, cancer type 2 diabetes) (Borbély and Müller, 2008; Lakó, 2014; Müller and Bácsné, 2018, Kinczel et al., 2020).

With the majority of time spent with work, and its steady rise suggests that worksite importance shouldn't be overlooked and that it should be the place where change can and should be made. Besides its convenience coming from the long hours spent there the importance of healthy workforce is a long standing truth among scholars (Katzmarzyk and Janssen, 2004; Oldridge, 2008; Medibank, 2007; Karoliny, 2016).

It is also important to take into consideration the remuneratory attribution of workplace health promotion (Balogh, 2018). Baicker et al., (2010) estimated that for every dollar an American company spent on health promotion leads to the saving of 3.27 dollar healthcare cost and 2,73 on sickday leave.

That is why a great deal of literature today deals with occupational health and workplace health promotion. Based on this fact, many studies focus on health conscious corporate behaviour (Péter et al., 2013, Karoliny, 2016) or occupational health research (Kun, 2014) and the competitive advantage coming from having healthy workforce (Nyitrainé Garaj, 2015; Szolnoki, 2013; Hegyesné Görgényi, 2018).

Workers' health is affected by stress, sedentary work, persistent loads, carrying heavy objects, environmental factors and social impacts (Nistor et al., 2015). The health status of employees can be adversely affected by high levels of stress, which can be caused by time constraints, unclear goals, and so on. Numerous studies also address workplace stress and its negative effects both on the employee and on the company as well (Calnan et al., 2001; Juhász, 2002; Olofsson et al., 2003; Lambert et al., 2003; Haffner and Bárdos, 2019).

Companies that promote health program experienced that absences due to illness have lowered, while they perceived a positive shift in their productivity. It should also be mentioned that the staff turnover or fluctuation of these companies also decreased while their image and reputation improved (Fritz, 2011).

In Hungary, several studies shed light on various health problems or risk factors caused by jobs, work tasks and working conditions (Hidvégi and Müller, 2009). The publication of a Hungarian study (Hidvégi et al., 2017) suggests physical activity and exercise based lifestyle programs in occupational health promotion, which can be an excellent means of compensating for sedentary work. Hartfiel et al., 2011 describes the positive effect of yoga on workers, one of the benefits of which was the stress relieving effect.

Bácsné et al., (2017) found that Hungarian, non multinational companies are already they realized that it was worth paying attention and money to the health of their employees. Most of the small and medium sized enterprises involved in their research, to some extent attention pay for your health. This is reflected in the fact

that even for the use of a sports facility, they even give their employees a sports lease, and some of them are held annually also organizes a bypass sports event.

Research among several international employees has shown that in increase the physical activity of the workers and their sporting activities, health programs focusing on helping the workers to be more physically active with longer term planning are more successful (Skogstad et al., 2018; Corbett et al., 2018). Although workplace sports are also important, the positive effect of such sports activity in improving the long term physical activity results of employees has been demonstrated which was performed several times a week by the employees outside the workplace (Burn et al., 2017; Makai, 2019).

In addition to motivation, this type of fringe benefit can also result in satisfaction and loyalty to the company, as many studies show that life satisfaction in athletes is higher (Hidvégi and Müller, 2009b).

All You Can Move Sport Pass (AYCM) and “Szép” Card as good practices of health incentives

The ALL YOU CAN MOVE Sport Pass is an employer benefit solution, which provides the employees of the partner companies access to hundreds of AYCM facilities, like gyms, swimming pools, dance studios, etc. The Sport Pass can be used daily, even every day in different AYCM facilities available in the chosen package (all-youcanmove.hu, 2020).

In 1999 the distributing company of the so called AYCM, the “Klub Rekreáció Sport és Rendezvényszervező Iroda” was established. In this year the company created its first product, the predecessor of the AYCM, the “Rekreációs Kártya” (Recreational Card). The main purpose of the Card was, to face the HR challenges of the 21st century, with offering their clients unlimited access to sports facilities like fitness clubs, swimming pools, saunas and others (allyoucanmove.hu, 2020).

Up until 2019 the company counts more than 850 sports facilities where they accept the Sport Pass, while more than 1,200 medium and large enterprises and government organizations provide AYCM Sport Pass to their employees (all-youcanmove.hu, 2020).

There are 6 main packages in the program from size “S” to size “XXL” with differences in costs and the amount of accessible AYCM facilities with the Card.

Two payment methods can be chosen: Monthly payment or payment in sum. Beyond this the company offers three types of payment constructions for their clients (allyoucanmove.hu, 2020):

1. Co-Payment or Co-Financing: “where the employer can choose to pay a part of the Employee’s AYCM Sport Pass – reaching maximum employee satisfaction. Giving as a fringe benefit (Tax Contribution is equal to the wage), through talent management or corporate wellness program, the employer is paying one part or the whole price of the AYCM Sport Pass.”

2. Full-Payment: “this option is for those, who would like to finance the employees’ AYCM Sport Pass completely, reaching the maximum employees’ satisfaction – on this field. The employer concludes an Engagement Agreement with

the AYCM, and the financial settlement of the cards will be made between the two companies (Tax Contribution is equal to the wage as well)."

3. Self-Payment: "where the employer concludes a Framework Agreement with the AYCM and agrees to announce the AYCM Sport Pass within its employees. The employees can individually decide if they would like to apply to the AYCM Sport Pass program, what package he/she needs and what payment method he/she would like to choose. In this construction the employer doesn't have any payment or administration obligation the employees will pay the AYCM Sport Pass individually from their salary or with OTP Cafeteria card – Gift subaccount."

A for the "Szép" Card, the "Széchenyi Pihenő" Card (Translation: Széchenyi Leisure Card) is a universal electronic voucher in Card format, which employees can receive from their employer as a fringe benefit within the cafeteria system. The main idea was to develop a benefit card system that helps the domestic economy recovery (szepkartyasok.hu, 2020).

The Card contains three subaccounts or "pockets" with different money limits. The biggest of the three is the accommodation pocket with 225 000 HUF, which can be used up for domestic accommodations, domestic travels or holidays. The annual limit of the second pocket is 150 000 HUF. Employees can pay with it for catering, warm dining in restaurants, canteens, buffays etc. And the third and smallest one with 75 000 HUF is the recreational pocket, which can be used up to pay in cultural and entertainment institutes or for sporting and health services (szepkart-yasok.hu, 2020).The amount transferred to the card is received in full by the employee, and can be used up full as well (szepkartyasok.hu, 2020).

Material and methods

The main focus of our research was to examine the effect of incentives used in workplace health promotion on the well-being of the employees and on promoting healthy lifestyle. The data for our primary research was collected via questionnaires. The questionnaire has been designed to provide information about the lifestyle of the average Hungarian employees, the fringe benefits as the incentives of physical activity and their utilization. Beyond this we were interested in finding out if there should be an initiation on the employers' side regarding physical activity would there be an inclination within the employees for its usage.

As we were particularly interested in the workplace habits of the respondents and their inclinations to workplace health incentives the questionnaires were filled out within the working strata, both on paper and online, using Google Survey platform.

The operative work was carried out using the IBM SPSS statistical data analysis program, in which descriptive statistical analyzes dominate (mean, standard deviation, median, mode).

The survey was created containing open and close ended, short answer questions. Besides this Likert scale (from 1 to 5) questions were generated in order to gather information what drives respondents to participate in sporting activities, how much these incentives affected the attitudes to the employees towards their employers.

In addition to descriptive statistics, we have used the Chi-square cross table test to determine the relationship between the nature of the employees' work and their habits regarding physical activity.

To evaluate the effect of these incentives on the sporting habit of worker's, among Card holders we have compared the frequency of participating in physical activities before and after obtaining any of the Card.

Introducing the sample

During the data collecting we've received 150 surveys both on paper and on the on line platform – from which after the data cleaning 133 were used. After analyzing the evaluable questionnaires we've received the following socio-demographic picture of the respondents.

Out of the 133 fill outs 53.4% of them (71 people) were made by women and 46.6%, or 62, were made by men, with an average age of 33.3 years (standard deviation 10.4). As the theme of our research suggests our main target group was the working strata. The age of our youngest respondent was 20 yrs, and the oldest 61 yrs.

As for the highest level of the education, with 59.8% (79 people) the majority of our respondents have high school (gymnasium, technical school, vocational school) qualification; 20.3% (27 people) have university degree; 19.5% (26 people) have collage degree, and one person (0.8%) has elementary school qualification as the highest level of education.

One of the more important questions was the nature of the respondents work. Are they white collar workers, or physical workers or even both? After evaluating the answers the following statistics were compiled (Table 2).

Table 1. The nature of the respondents work
Source: Own research (2020)

| | Frequency (Persons) | Percent (%) |
|---------------|------------------------|----------------|
| Physical work | 20 | 15 |
| Mental work | 83 | 62.4 |
| Both | 30 | 22.6 |
| Total | 133 | 100 |

As Table 1, above shows the majority of the respondents (62.4%) are white collar workers while only 37.6% of them does physical work with some kind of intensity. This means that our target group spends the majority of their days with little to no physical activity while working. The fact that the greater part of those participating in the survey are doing mental work advantageous result, because the effect of workplace health incentives can be analyzed more effectively among employees with sedentary lifestyle.

In addition to this we have asked them to estimate the net value of their monthly salary and if they possess any one of the Cards mentioned above.

As the left diagram of Figure 1 shows the majority of those questioned have either Szép Card, AYCM Sport Pass or both (Cumulative percentage is 60.9%), while 39.1% neither. Based on these answers, for further analyzation the respondents were broken down into two groups, where in the group holding Cards we are examining the usage, motivations and its impact on lifestyle and on the attitude towards the employers. While in the other one question are asked regarding their willingness, so as to would they take up on the opportunity if such incentives were introduced by their employers

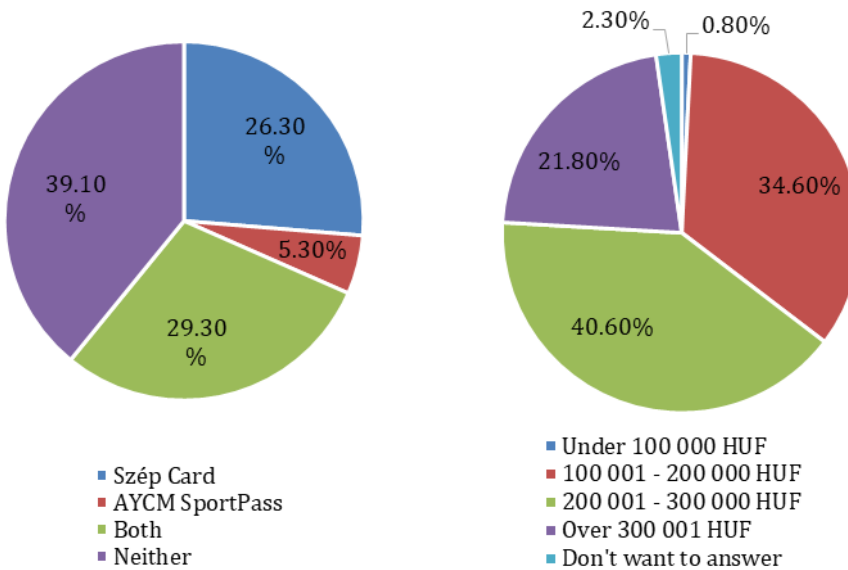


Figure 1. The Card possession and income situation of the respondents
Source: Own research (2020)

From the 133, three people (0.8%) opted out of answering question about their monthly income. Among those willing to answer the majority (40.6%) estimated the net value of their monthly income between 200 001 and 300 000 HUF (1 Euro = around 354 HUF as of 05.01.2020). The second greatest strata earns between 100 000 and 200 001 HUF, while those earning over 300 001 HUF represented 21.8% of the group.

Because the use of Szép Card is not restricted to sports or health purposes only we have created a question to see if respondents have any sport or health related spendings with this type of card.

From 81 Szép Card holders relatively small percent uses the Card for this purpose (Table 2). It is not surprising however, since the Leisure pocket, which can be used for this reason is the smallest of three and because the other two pockets are more desirable, since they can be used for accommodations and holidays or catering and warm dining. Besides this employers can decide if they want to manage the allocations of the pockets so this can be more restricted or they can entrust it to their employees.

Table 2. The utilization of Szép Card regarding health or sport related spendings
Source: Own research (2020)

| | Frequency (Persons) | Percent (%) |
|-------------------------|---------------------|-------------|
| Sport purpose spending | 9 | 11.1 |
| Health purpose spending | 12 | 14.8 |
| Both | 12 | 14.8 |
| Neither | 48 | 59.3 |
| Total | 81 | 100 |

Results of the correlation tests

For us to get a basic picture about the sporting habits of the employees especially considering the nature of their work we have taken a Chi2 test to see whether the type of work they do affects their physical activity (Figure 2).

Do you participate in any type of sporting activity? * The nature of your work?
Crosstabulation

| | | | The nature of your work? | | | Total |
|--|-----------------------------------|-----------------------------------|--------------------------|--------|--------|-------|
| | | | Physical | Mental | Both | |
| Do you participate in any type of sporting activity? | Yes | Count | 15 | 78 | 25 | 118 |
| | | % within The nature of your work? | 75,0% | 94,0% | 83,3% | 88,7% |
| | No | Count | 5 | 5 | 5 | 15 |
| | | % within The nature of your work? | 25,0% | 6,0% | 16,7% | 11,3% |
| Total | Count | 20 | 83 | 30 | 133 | |
| | % within The nature of your work? | 100,0% | 100,0% | 100,0% | 100,0% | |

Chi-Square Tests

| | Value | df | Asymptotic Significance (2-sided) |
|------------------------------|--------------------|----|-----------------------------------|
| Pearson Chi-Square | 6,924 ^a | 2 | ,031 |
| Likelihood Ratio | 6,396 | 2 | ,041 |
| Linear-by-Linear Association | ,256 | 1 | ,613 |
| N of Valid Cases | 133 | | |

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 2,26.

Figure 2. The Card possession and income situation of the respondents
Source: Own research (2020)

For the question: “Do you participate in any type of sporting activities?” 75% of the physical workers answered with yes. From those who have both physical and intellectual work 83.3% chose yes, while 94% of the white collar workers said they

participate in sporting activities with some kind of intensity. The results showed significant differences between the respondents regarding the nature of their work ($\text{Chi}^2=6.92$, $\text{df}=2$, $p=0.031$).

Research has shown that the physical activity of those performing mental work is significantly higher than that of those performing mixed or physical work. This finding is important because we can conclude that white collar workers sought recreational sports to compensate for sedentary and inactive work. The lower percentage of participation among physical workers is due to the fact that it is true that physical workers are more active, but it is important to note that the activity spent at work is not a substitute for the beneficial effects of sport on the body.

Since white collar workers are clearly favor physical activities outside work and actively sougning it and engaging in it employers should take up on the opportunity and assist it, moreover they should encourage it, considering the positive effect it has on productivity, competitiveness and its cost reducing quality.

Results

First, we wanted to take look at what drives these employees to participate in sporting activities. For this reason, we have created a Likert scale question where respondents could rate the 10 statements from 1 to 5 where 1 means the respondent doesn't agree at all, while 5 means they fully agree with the statement.

Figure 3 below shows the collective results to this question.

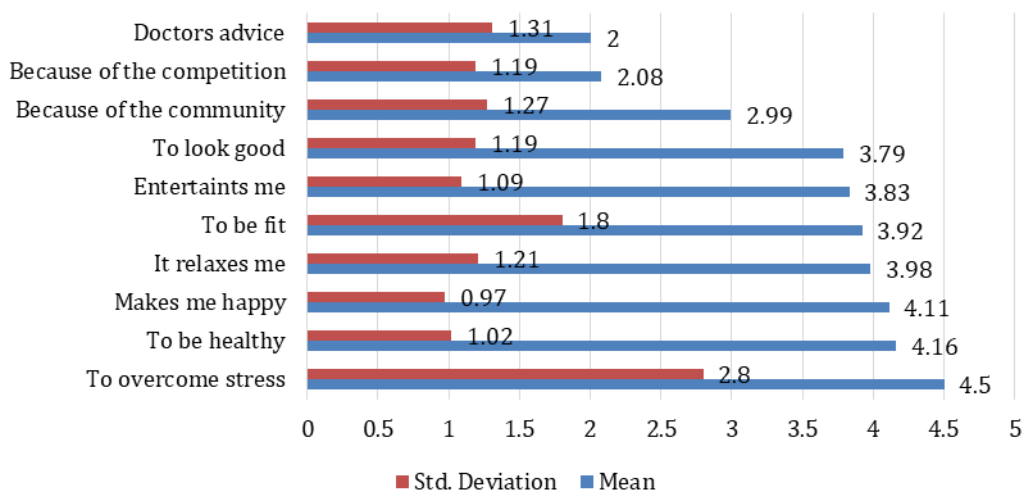


Figure 3. Why do respondents take part in sporting activities? (on a Likert scale from 1 to 5 where 1 means the respondent doesn't agree at all, while 5 means they fully agree with the statement)

Source: Own research (2020)

With an average score of 4.5 from 5, the highest rated statement is that employees are participating in physical activities to overcome stress. As the results shows respondents use physical activities as tools to help relieve stress, which is an important outcome considering the fact that workplace stress is a growing concern

in today's fast globalizing and competitive economy (Van der Zwan et al., 2015). In addition to the impact stress have on ones well-being it has a great economical effect as well, since workplace induced stress can increase absenteeism; create pervasive dysfunctional pattern and lower productivity (Colligan and Higgins, 2006).

As the results indicates workers regard physical activity's stress relieving quality highest on the list. Because of this reason and the increasing seriousness of stress, employers should take into account to incite their employees to exercise more. This is a highly remuneratory investment and the consciousness of the respondents regarding Physical activity's effect indicates their willingness to take on the opportunity if it should be given.

The second highest rated statement, with an average score of 4.16 is linked to health as well. The health consciousness nature of employees' is clearly present among the respondents. This also indicates a positive attitude towards physical activities.

The statements "Makes me happy" (Avg. score: 4.11) "Relaxes me" (Avg. score: 3.98) which also relates back to the stress relieving attribution of physical activities scored third and fourth highest on the list.

In conclusion health conscious driving and motivating factors scored higher on this question while secondary attributions of sporting activities such as competition and the community ended up at the back. The conscious attitude of the employees is a positive result both from the standpoint of health development and both from willingness. Because this type of awareness suggests that there is a need among employees for this type of incentives.

In order to evaluate the effect workplace health promotion incentives have on the habits of the employees we have asked them how often they participated in any kind of sporting activities and how did it change after using one. For this reason, the answers of those holding a Card (N=81) were analyzed with Paired Sample T Test, and the frequencies of the two question was presented graphically (Figure 4).

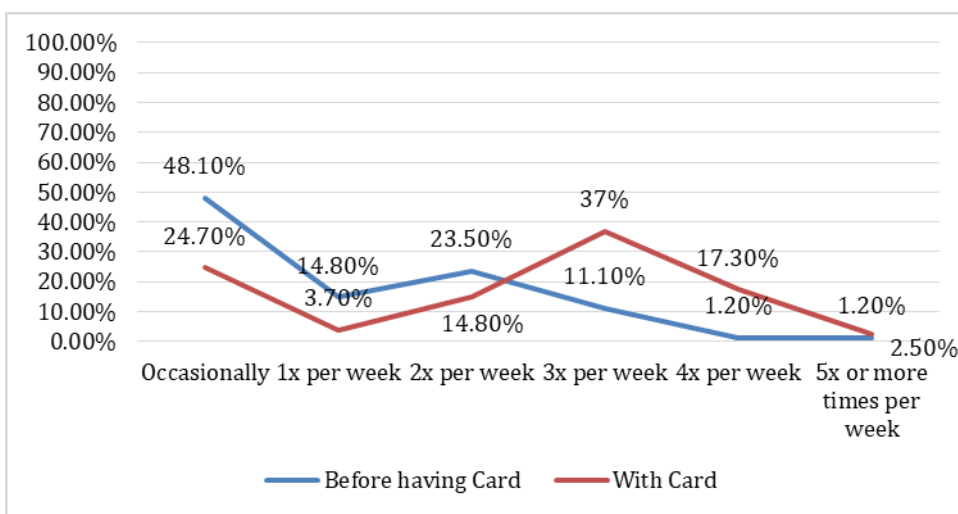


Figure 4. The intensity of sporting activities before owning a Card and after
Source: Own research (2020)

The results showed that before owning any type of Card the respondents took part in sporting activities with an average of 2.06 (Sd=1.22) times per week frequency, whilst after getting one and using it this amount increased to 3.26 (Sd=1.5) times per week ($t=-7.09$, $df=80$, $p=0.000$). The results therefore confirm that by using a Card employees participate in sporting activities significantly more than before owning one (Figure 4).

This outcome draws attention to the fact that the card can be a powerful motivating and inciting tool in increasing the sports activities of employees. And because physical activities improve health, it certainly shouldn't be overlooked. Furthermore, this results suggests that, given the significant contribution of a healthy workforce to organizational performance, productivity, competitiveness, the cost reducing quality of the employees' health and therefore the remuneratory nature of the investment makes workplace health promotion incentives, as fringe benefits for the employees a desirable construction in organization programs.

Among those not having any type of the two studied Card (N=52) we were interested in finding out if there should be an initiation on the employers' side regarding physical activity inciting fringe benefits would there be an inclination within the employees for its usage.

For this reason we have created a Likert scale question, with the question "Would you participate more in any sporting activities if ...?" where respondents could rate from 1 to 5 where 1 indicated the respondent doesn't agree at all, and 5 where they fully agreed with the statement

Table 3. Would you participate more frequently in any type of sporting activities if
Source: Own research (2020)

| | Frequency (Persons) | Percent (%) |
|--------------------|------------------------|----------------|
| Don't agree at all | 7 | 13.5 |
| Slightly agree | 2 | 3.8 |
| Agree | 21 | 40.4 |
| Strongly agree | 12 | 23.1 |
| Fully agree | 10 | 19.2 |
| Total | 52 | 100 |

As Table 3 demonstrates from the 52 respondents who don't own a Card, only 13.5% is fully indifferent towards health promoting fringe benefits, while 86.5% percent showed inclination to it with some kind of intensity.

The positive result of T sample, and the willingness showed by those not receiving from this incentives shows that there is a clear need among employees regarding health promoting benefits from their employers, and that it is a utilized construction.

After finding out that there is a clear positive stance towards health promoting fringe benefits among both those receiving it and those of not, we were curious if it had any impact on attitude towards employers providing it. We have asked the

respondents to rate that receiving these fringe benefits either improves the attitude towards their employers (question 1) or worsen it (question 2).

The overall sentiment of the respondents with an average score of 4.23 (Sd.= 1.2) out of 5 (1 indicated the respondent doesn't agreed at all, and 5 where they fully agreed with the statement) a positive attitude, which coincide the studied literature about the improvement of the company's image, reputation and loyalty to the employer, which helps with fluctuation and productivity as well. While question two that asked about whether it worsens the employees attitude showed a relatively low score 1.33 (Sd.=1.12).

The results highlighted that besides the positive direct effect in business sector, employers should invest in their employees health, as it is also improve the work moral and the employees attitude to their employers.

Conclusion

The research highlighted the differences caused by the employees' nature of work. The results showed that white collar workers engage more frequently in sporting activities outside their work than physical workers, since they spend the majority of their time with little to no physical activities while working. They try to compensate this sedentary lifestyle, as they actively sought opportunities that offer physical activities. The lower percentage of participation among physical workers is due to the fact that it is true that physical workers are more active, but it is important to note that the activity spent at work is not a substitute for the beneficial effects of sport on the body.

The analyzations of motivating factors showed a health conscious attitude among the employees. With the highest scored driving factors regarding exercise: stress relieving and relaxing quality, healthy and fitness and of course its delighting effect. We assume that this type of awareness has a positive impact in the utilization of these incentives.

In order to evaluate the effect workplace health promoting fringe benefits have on the habits of the employees we have chosen two of these incentives from Hungarian health promotion practices, namely the "Szép" Card (an electric voucher system with account that can be used for sport and health purposes) and the All You Can Move Sport Pass (AYCM) (an ultimate SportPass that makes hundreds of sporting facilities available for its owners with unlimited using time) and asked the respondents how often did they participate in any kind of sporting activities before owning one of these Cards and how did it change after using one. After analyzing the results, we can conclude that there is a positive significance. It showed that by using a Card, employees participate in sporting activities significantly more than before owning one.

And among those not having any type of the two studied Card we were interested in finding out if there should be an initiation on the employers' side regarding the encouragement for physical activity, would there be an inclination within the employees for its usage.

And since the results confirmed that there is a clear positive stance towards health promoting fringe benefits among both those receiving it and those of not, we were curious if it had any impact on attitude towards employers providing it.

The outcome supported our previous assumptions. The overall sentiment of the respondents was that in fact it did improve the reputation of their employers and the company as well.

From the awareness and health conscious behavior of the employees', the significant effect it has on the frequency of physical activity engagement, the willingness of those who doesn't receive it and the positive impact it has on the reputation of the company it is clear that workplace health promotion incentives are working, it is a remuneratory investment, and because these facts employers should take up on the opportunity and use it for both their employees and their company' sake.

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The wellness habits of men and women in the Northern Great Plain Region

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Abstract: In the past decades, the harmony of body and soul was getting more and more important, the balance, the self-confidence, and the positive-being, which is supported mostly by health tourism, so this section is improving with huge steps to serve the increasing needs fluently. For the effect of the consecutive social changes, the rules of genders have also changed. At the same time changes could be realized in the consumption habits of different genders. The resource took place from September to December 2018. It happened with a questionnaire survey; we asked the customers of hotels in the Northern Great Plain Region, and the answering was optional – they do it on their own choice. We investigated the participants' data through different dimensions and look for the answer to the question along these dimensions that which specifies had the service customers.

Keywords: wellness, men, woman, consumption habits

Introduction

In the last two decades, the increasing tendency of the user circle of wellness service was realized what's a witness is the establishment of the increasing number of different typed wellness & spa centers, which have huge spa traditions, for example, Hungary.

Cause our need for the modern stressful life and the various and good quality tourist points with a lot of wellness content, more and more people pay attention to this segment of tourism because they feel better right after their first visit and they try to practice these experiences over and over. Also the rivalry of different cultures and the natural facilities of each regions with their advanced offer in wellness & spa,

the effect on the fluent rivalry between them; automatically improve their offers, contents for their customers which is for their benefit and because of this the destinations which are chosen have rich selection of wellness & spa, in which there are some leader countries, just like Hungary.

Wellness is the novel approach of a healthy lifestyle such as a consciously chosen one, where near the harmonic improve fitness the creation of the balance of body, soul, and mind is also the goal (Törőcsik, 2014).

„Wellness is the collection of personalized health programs and in certain cases the combined use of cures and treatments. For the customers who spend their holidays or rest times in wellness hotels to relax after everyday stress and tiredness, to calm and upload their body and soul. The parts of wellness can be (gymnastics, healthy eating, swimming, fitness, massage, etc.) They can be built in their everyday life but these services are mostly be taken during a cure in a hotel (4-5days or a week)" (Hézsóné, 2013).

Wellness is the same age as humanity and the aspiration of getting the fight with their abilities, improve them and prevent illnesses. The aspiration dates back to ancient times to get the health of the body and soul. The expression itself comes from an American doctor, named Halbert Dunn, who wrote it down in 1950 (Hojcska and Szabó, 2010).

Nowadays, this economic importance of wellness is quite big; it improves with huge dynamism, in America and West-Europe it has a leading role. The program of the perfect being by Kenneth H. Cooper was published in 1990, defines it firstly as a lifestyle. He says we should realize our balance in three areas: 1. not too much and not too less precept – balanced performance; 2. making aerobic program – it advises at least 20 minutes of aerobic physical training with working pulse 3-4 times a week; 3. Positive Eating Plan – it gives the recommended rate of our main nutritions and meals.

Besides the listed levels Cooper also keeps the emotional balance important, that appropriate relaxing sleeping, the systematic holidays and the stress reduction.

Sebastian Kneipp (2003) German naturopath also tried to find out the principles of a healthy lifestyle. The base pillars of his philosophy are dietetic, exercise therapy, body-soul balance, and hydro-therapy.

According to Donald Ardell (1982), wellness is an aspiration for positive manifestations, individual responsibilities of health, development of the environment, balanced lifestyle, self-consciousness, and completion of an individual wellness plan.

John W. Travis, Regina Sara Ryan (2004) says that the components of wellness are: Csíkszentmihályi Mihály (psychologist, educator 1991) says: „The perfect experience is such a thing that not only happens to us but we create it ourselves" (Győri, 2013). It often occurs in sports, games, arts, and hobbies.

Lifestyle changes can be helped by: stress relief technics; relax helping activities; alternative exercise therapy; massage therapy; nature medicine; reform eating; use of beauty care principles.

Task: personalized exercise plan; medical condition survey; eating and lifestyle guidance; creation of good being.

Consumption differences between genders

Among the social changes the roles of genders also changed. At the same time changes can be realized in the typical consumption habits draws up Mária Törőcsik in her book „Consumption attitude”, 2011, the customer habits of the „new men and women” (Törőcsik, 2011).

About the new men, we can say that they are mostly well-qualified upper- and middle-class men who have to act in traditional and new social roles as well. So their behavior samples in connection with consumption can be contradictory to each other. As customers, they are more interested in the chances given by new technologies. They have adventurousness, which they live out in organizing exotic journeys and doing extreme sports. Modern men are getting more opened not only in health-preservation but also in beauty and body care. So they have more interest in linking products and services.

The economical role of „new women” is increasing, as the female members of the world's population get into education more often. As they get more qualified they prevail better on the labor market and become potential customers with individual incomes. In their family mostly these women are the ones who make decisions and now they have also economical potential behind them.

Modern women can change customer's habits, as an example, the movement of bio- and environmental awareness started in the last decade.

The influential trends on customers affect four main groups of new women:

Adventure-seeking girls' group compact young women from big cities, who are not career-oriented, but mostly want to have fun. For ecospiritists, self-realization is important, the environmental consciousness, they are interested in other cultures and critical with things seen and heard in the media (Horváth, 2015).

The new housewives find self-realization in the leading of the family and the household. They are well-experienced customers of media, so they can be touched by well-organized advertisements easily, but they are more interested in classical quality products. Modern Amazon is tried to get the fastidious balance between family and career, and services are important to them. They are future-oriented, but not careerists.

Survey of holiday habits

Danubius Hotels made research in 2016 in which they asked more than 6500 people to crawl the habits of their customers at the beginning of the year. It is not usual to use wellness alone, free breakfast is more important than free wifi, and we like to make the beds before leaving the rooms. Among Hungarian travelers, the most frequent is the domestic holiday with half-board service, preferably near water and the politeness of the staff is important.

In the service of hotels and restaurants, the main role is for the internet, because it is the first place of information searching and it is also true if we cannot point the internet as a clear source (Neulinger et al., 2009).

With the use of the internet, customers are more informed and conscious than before (Herman et al., 2020; Xiang et al., 2015). They know exactly what services they want to take, they expend time and energy to know details, and they demand higher needs besides providers.

The research

The research took place between September and December of 2018. It happened with the questionnaire, we asked the guests came to hotels in the Northern Great Plain area and the answering was a free choice. The questions of the questionnaire consist of simple choice, multiple-choice, opened questions and Likert scale.

The questions of the research apply to the parameters characterizing the wellness services of the Northern Great Plain area. The object of our investigation was the usual statistic trait of the ones who take part in service to help the wellness providers in the region to specify the target group. The target group of the research was the ones who use wellness service. The data of the participants of the research were examined through more dimensions and we search the answers through these dimensions for the question that which traits have the ones who take the service. This article is part of bigger research.

Results

One of these dimensions was the difference between genders. 43% of responders were men (72 people) and 56% were women (94 people). Women were cuter divided by age than men, as can be seen in table 1. so we took our research by the division of gender and mostly focused on women.

Table 1. Division of genders N=166

| | | Age | | | | All |
|--------|--------|-------------|-------------|-------------|---------------|------------|
| | | 18-29 years | 30-39 years | 40-59 years | Over 60 years | |
| Gender | Male | 34 | 15 | 14 | 9 | 72 |
| | Female | 36 | 20 | 28 | 10 | 94 |
| All | | 70 | 35 | 42 | 19 | 166 |

Half of the women lived in marriage or relationship, 31 were single, 11 were divorced and 2 were widows. Men took part in the research through similar parameters, 36 were married, 29 were single, 4 were divorced and 2 were widows.

In education women showed balanced rates; nearly the same number had middle and higher education (47 and 46 people) while with men this rate was 45 and 27 for middle education.

The next dimension in which we made a difference in our research between men and women was the net monthly income of the family per person. While 60% of the whole answerers said the income for one person is 100000-200000 HUF, the ones who had lower incomes were mostly women (under 100000 HUF, 20 people) than men (7people). The ones who had higher incomes (more than 300000 HUF) were mostly men, 25 people, opposite the 16 women.

In the usual search of wellness, the first group of questions was about their opinion about wellness. They had to mark the statements on a 4 rate scale and we separate it by genders. They did not answer the questions in each case, so we mention it in the questions.

The first group of questions consisted of negative and positive statements about wellness, which can be often heard and can be built on prejudice.

In the research, most of the answerers agreed that wellness is consists of sauna and massage, then comes the expectation that wellness should be near some kind of thermal water. They disagreed with the statement that it is only for youth, families or older people. In table 2, we can see that they also rated low expensive service.

Table 2. Opinions about wellness habits N=166

| | Average | Dispersion |
|---|----------------|-------------------|
| Wellness services are mostly for young people | 1,93 | 0,898 |
| Wellness services are mostly for families | 2,01 | 1,123 |
| Wellness services are mostly for older people | 2,15 | 1,158 |
| Wellness is aa too expensive service for me | 2,16 | 1,201 |
| Wellness service is for rich people | 2,55 | 1,391 |
| The oness who go to wellness take more care about their health in their everyday life | 2,97 | 1,668 |
| Wellnesss is trendy and fashionable in our country | 3,84 | 1,684 |
| Wellness services are for the preservation of the health of body and soul | 4,38 | 1,657 |
| Thermal water is a must have for wellness services | 4,43 | 1,696 |
| Sauna and massage are the parts of wellness services | 5,02 | 1,475 |

We also watched this question by genders and we examined the average and dispersion. Based on these we stayed out a rating scale and found out that there were no main differences between genders, but in huger research, it can be realized.

While men said it is at least for young people, women disagreed that it is for families. This question is interesting because it is quite divisive how child-friendly is wellness, it is a family program, or it is for young people. As we see the number of singles and families in answerers, we can state that young single men think wellness is a part of family life. But in fact, both genders search for sauna, massage, thermal water and the reformation of body and soul during a wellness holiday.

Table 3. Opinions about wellness by genders N=166

| | Males | Females |
|---|--------------|----------------|
| Wellness services are mostly for families | 10 | 9 |
| Wellness services are mostly for young people | 9 | 10 |
| Wellness is a too expensive service for me | 8 | 7 |
| Wellnesss services are mostly for older people | 7 | 8 |
| Wellness services are the privilages of rich people | 6 | 6 |
| The oness who go to wellness take more care about their health in everyday life | 5 | 5 |
| Wellness is trendy andd fashionable in our country | 4 | 4 |
| Wellness services are for the preservation of the health of body and soul | 3 | 2 |
| Thermaal water is a must have for wellness | 2 | 3 |
| Sauna and massage are the parts of wellness | 1 | 1 |

For the question of which factor is the most important men and women gave the same answer so we did not mention it. The common sequence and the rate of average and dispersion can be seen in table 4. They agreed most in that a holiday place does not need to be abroad and disagreed the most about sports facilities.

Table 4. The storehouse of services and possibilities N=166

| Sequence | Statements | Average | Dispersion |
|----------|--|---------|------------|
| 10 | The resort should be abroad | 1,83 | 0,763 |
| 9 | The resort should be close to my living place | 2,25 | 1,454 |
| 8 | Should be suitable for hiking and trips | 3,12 | 1,591 |
| 7 | The resort should have cultural programmes | 3,15 | 1,454 |
| 6 | Could bbe paid by holiday vouchers | 3,18 | 1,84 |
| 5 | The resort should be inland | 3,36 | 1,706 |
| 4 | Child preservation and child programmes should be held | 3,65 | 1,909 |
| 3 | The resort should be obstacle cleared | 3,69 | 1,916 |
| 2 | The resort should have sport facilities | 4,14 | 2,033 |
| 1 | The surroundingss should be calm | 4,71 | 1,652 |

Three rates stated in regions also made a difference between men and women and we can see that although most of the answerers were women in spite of that the answers of men agreed with the common rate. While men thought that the human factor is more important, just like residents and the development of the region, women thought that the price of the resort is important and how is the cultural life in the village. It can be seen in the agreement of the price of the resort.

This question was completed with how true is that they were satisfied with the service of the Northern Great Plain region. Here despite others, the experiences that were held important by women were more frequent. There were no huge differences, only in how satisfied they were with the staff. This shows that in hospitality people who they met were more determinative than other regional differences. This can be seen in the results of table 6.

Table 5. Importance of the region N=166

| Statements | Average | Dispersion | Sequence | | |
|---|---------|------------|----------|-------|---------|
| | | | All | Males | Females |
| Advanced infrastructure | 2,82 | 0,883 | 7 | 7 | 7 |
| Clean, orderly villages | 2,94 | 0,906 | 6 | 6 | 6 |
| Sparkling cultural life | 3,07 | 1,156 | 5 | 5 | 4 |
| Dinamically developing region | 3,13 | 1,013 | 4 | 4 | 5 |
| Favorable price for resort | 3,24 | 0,788 | 3 | 3 | 2 |
| Friendly, hospitable residents | 3,25 | 0,953 | 2 | 2 | 3 |
| Advanced medical tourism services (thermal spa and baths) | 3,54 | 0,711 | 1 | 1 | 1 |

Table 6. Regional satisfaction

| Statements | Average | Dispersion | sequence | | |
|---|---------|------------|----------|-------|---------|
| | | | All | Males | Females |
| With the standards off price | 3,24 | 0,752 | 5 | 5 | 5 |
| With the variety of available services | 3,36 | 0,782 | 4 | 3 | 4 |
| Wwith the offered cultural and freetime programmes of the regon | 3,43 | 1,052 | 3 | 4 | 3 |
| With the staff | 3,54 | 0,705 | 2 | 2 | 2 |
| With the level of service | 3,63 | 0,598 | 1 | 1 | 1 |

Table 7. Taking the services again N=166

| | | Would you like to take this service again? | | | | All |
|--------|--------|--|------------|------------|------------|-----|
| | | Surely not | Mainly not | Mainly yes | Surely yes | |
| Gender | Female | 0 | 5 | 35 | 55 | 95 |
| | Male | 2 | 2 | 38 | 29 | 71 |
| All | | 2 | 7 | 73 | 84 | 166 |

And finally, we asked how sure they are that they will take this service again. We got the answer that men were more unsatisfied than women, that satisfaction of women (57%) was higher than men's (41%). So maybe women got the service they expected more than men.

Conclusion

To sum up the answers of men and women in the examined region we got this result. Although there are basic differences in the economic, educational status of men and women, the claims in spite of the region do not have main differences and though men are less satisfied, we can say that they were satisfied with the region and the services chosen and according to their admission they would love to visit here again.

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Essential Aspects of Beach Volleyball Technique

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Abstract: Beach volleyball is a sports game practiced during performance sports activities and people who love to move, or for recreational purposes, Loisir. The game of beach volleyball resembles the game of indoor volleyball in terms of the similarity of essential execution by the volleyball player and some actions of attack or defense. However, the two sports also have significant differences. This is making beach volleyball one of the most famous and practiced sports, especially in the hot season. Also, statistics highlight that sports with the ball up in the open air have the most massive audiences among the sports practiced at the Summer Olympics.

Keywords: beach volleyball, technique, beach volleyball fundamentals

Introduction

The volleyball game is an acyclic team game, where muscular work is of a speed-power, accuracy-coordinating character (Kozina et al., 2018). The volleyball game has developed in speed and strength characteristics, being physical (Sopa, 2019).

Beach volleyball is a sports game practiced during performance sports activities and people who love to move, or for recreational purposes, Loisir. The game of beach volleyball resembles the game of indoor volleyball in terms of the similarity of essential execution by the volleyball player and some actions of attack or defense. However, the two sports have also significant differences. This is making beach volleyball one of the most famous and practiced sports, especially in the hot season. Also, statistics highlight that sports with the ball up in the open air have the most massive audiences among the sports practiced at the Summer Olympics.

Volleyball games, relatively simple, once, by training players and multilateral actions' scroll speed, get to enjoy a wide increasingly accepted by the audience (Cojocaru and Cojocaru, 2018). The game of volleyball has a wide range of actions in

the game, from the simplest to the most complex. This required the players to continue training and persevering and staging the sequence of processing the learning and teaching for coaches, which gives a touch of increased subtlety of this game (Szabo, 2015). A volleyball player's use of explosive power in vertical, horizontal, and side movements is critical (Sopa, 2019).

Volleyball has become one of the most practiced sports in the world (Herman et al., 2018). The volleyball game requires expertise in several physical fitness and performance and often depends on an individual's ability to jump on very high-level parameters (Szabo, 2015).

As games become more balanced, there is a greater need to understand whether winning teams are better at putting into practice the skills of playing more points or making fewer mistakes (Szabo et al., 2018).

Performance in collective sports is mirrored by a series of inter-relational components, in the middle of a complex universe where there are various phenomena expressed through general and specific systemic relationships that act synergistically to achieve sporting performances (Szabo et al., 2019).

One of the main reasons why beach volleyball is so famous and increasingly popular around the world is that unlike indoor volleyball, where a player specializes in a particular position, he will carry out specific training only for that activity, in beach volleyball, a player must master all the elements and technical procedures encountered. Thus, in the game of beach volleyball, a player must have an excellent command of the following elements: service, receiving, setting the ball for the attack with an overhand pass or a forearm pass, attack, blocking, recovering the ball with or without diving, while in indoor volleyball a player can only specialize for setting the ball, attacking and blocking the ball, and there is even the possibility of not serving at all.

In indoor volleyball, a player can be a reserve and can do nothing but hope that he will be used in the team by changing a starting player, and if this does not happen, he will have to overcome this psychological impasse and prepare for the next match. Beach volleyball is an intermittent team sport played by two teams of two players on a sand court divided by a net (Kiraly, 1999). It is characterized by frequent high-intensity efforts interposed by short recovery phases (Palao et al., 2012). The performance involves jumps (e.g. attacking, serving, blocking), short sprints, direction changes, and diving digs (Natali et al., 2017). During a single set, Palao et al., (2012) observed that defenders and blockers performed an average of 27 and 31 jumps, respectively. Also, moving on sand increases energy costs compared to moving on the solid ground (Zamparo, 1992).

Beach volleyball is played under demanding environmental conditions: Zetou et al., (2008) reported that during over 50 matches analyzed in an official tournament, the mean air temperature was 33.6°C (max 38°C), and mean humidity was 56% (max 75%). While there are no changes in beach volleyball, a player has to cover a much larger area of the gym than in indoor volleyball, reaching to touch the ball more often, almost every time it is in their part of the court. For this aspect, the players need an excellent physical condition, jumping from sand being much more massive than the ones in the gym; they require specific physical training among the

athletes, the muscular strength development training carried out in a gym getting a special significance.

Beach volley game is divided into two phases: side out and counter attack. The sequence of beach volleyball actions is: serve, serve reception, set, attack, block, and dig (George and Panagiotis, 2008). The side out phase includes: serve reception, setting, and attack. The counterattack includes: block, dig, set, and attack (Costa et al., 2012).

In beach volleyball over the years, with its changes to the rules, the athlete should fundamentally provide good physical strength, such as speed (reaction and displacement), agility, explosive power, and maximum force (Bizzocchi, 2008; Lehnert et al., 2009; Pereira et al., 2015; Pastore et al., 2015).

Beach volleyball is less harmful to the players' body integrity; it does not put so much pressure on the ligaments and joints, as a big advantage it can be practiced until a considerable age. In beach volleyball, there is a significant amount of landings following jump movements related to high forces in the lower limb joints (Bisseling et al., 2007; Edwards et al., 2012; Lindner et al., 2012). Such high forces may cause acute and overuse injuries like anterior cruciate ligament ruptures or patellar tendinopathies, respectively (Bahr and Reeser, 2003).

In beach volleyball, each of the competitors needs to know their role during the point dispute. Thus, when the player hits the ball at service, the players must know exactly what they have to do in the next phase, and the two must have a game plan from the very beginning regarding who will receive the service. Usually, if the players are at the same quality level of the game, each occupies 50% of the court. If one player is more valuable than the other, he occupies 60% of the court; the other will cover only 40%. If the age difference is significant between the two partners, one of them being a player over 45-50 years old, the more mobile player will cover 75% of the field in the receiving position.

Setting the ball in beach volleyball

Once the ball has left the receiver's hands, his teammate must already be set in the middle of the field and wait for the ball to be set for the player's attack that received the ball from service. There are two types of setting for attacking (lifting): setting the ball with two hands from above – the overhand pass, or setting with two hands together, from a lower position – the forearm pass. A good player must master both. Beach volleyball players often use the forearm instead of the overhand pass because of the risk of a technical error due to an incorrect movement, although the overhand pass is more precise (Koch and Tilp, 2009). Hernandez et al., (2004) analyzed the kinematics of the overhand pass in indoor volleyball; however, kinematic analysis of the overhand pass in beach volleyball lacks. A good setter will be able to put the ball in the attacking position no matter where it bounces from the colleague's hand after receiving the ball from service, and for this, the setter must have the ability to execute the following technical elements in the following order:

1. Deciphering the opposing defense: the setter must study very quickly how to prepare the opposing defense to play the next offensive phase. Depending on how the opponents are arranged, the setter must decide in a short time where he will send the ball for the attack.

In beach volleyball, the efficacy of the reception is high. In nine out of ten receptions, the execution allows the team to build an attack (Lacerda and Mesquita, 2003; Lopez et al., 2009). The reason for this is probably the difficulty of moving in the sand, in addition to communication problems in the zone between the receivers (Noël et al., 2016; Smith, 2006).

2. Receiving anticipation: To execute the setting for attack, the setter must be very careful in the direction that the ball gets after executing the receiving by his colleague. Ideally, the receiving will be a perfect one, and the ball will get a direct trajectory to the place where the setter is located. It happens very often that the receiving is less successful or even wrong, and then the setter must be prepared for a swift move, because when he comes in contact with the ball to be in a firm position, static so he has the best chance of sending the ball to where his partner wanted it to go. Reception analysis should consider the type of service and, if possible, the serve speed (Busca et al., 2012; Palao and Valades, 2014).

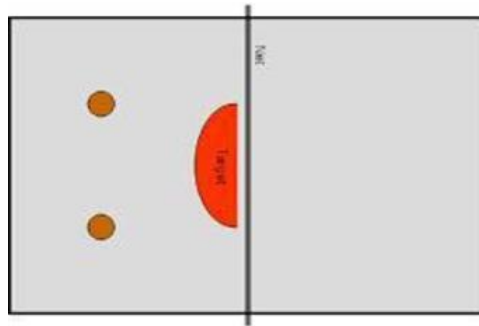


Figure 1. Receiving zone from the opponent service

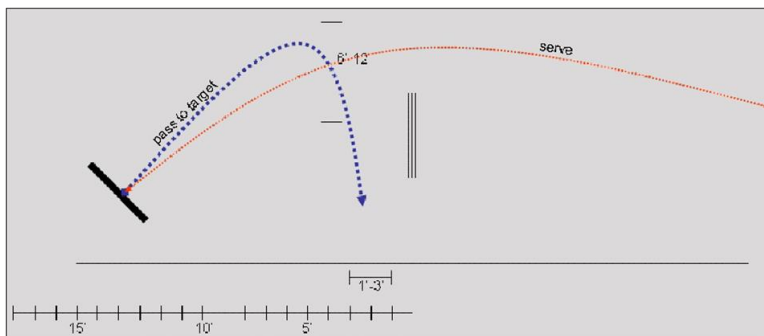


Figure 2. Perfect receiving of the service

3. Entering a stable position (planting): like in the case of the receiving position, in this case, a swift movement of the setter is needed so that he positions himself on the downward trajectory of the ball (with the hope that it will land in the target area desired by both players). The feet must firmly be embedded in the sand to give a solid base to the absolute position which requires the legs to be apart shoulder width, the knees bent, the body bent forward so that it can efficiently

perform a vertical movement to come into contact with the ball quickly or sometimes even to make a jump in order to prevent the ball from passing over the net following an imperfect receiving. Emphasis is placed on the use of leg muscles, and of course, special attention is needed on the ball that should not be overlooked at any time. The footwork is an essential aspect in order to prepare the correct execution position of the setting (Tilp and Rindler, 2013). The shoulders should be close to the net, forming an ideal angle of 90 degrees, so that the ball can be easily sent both forward and backward, and the foot that is closest to the net should be placed approximately 10-15 cm further than the one from the center of the court.

4. Bending the legs: if a setting is used (as in most cases) with the overhand pass, the legs must be bent at the beginning of the movement to execute the ball set for the attack. This aspect makes the overhand setting, which differs from the one used with the forearm pass, to be precise, strong enough and sent exactly where the teammate wants it. The force gives the power with which the ball leaves the setter's hand that the legs develop at the moment of their extension when returning from flexion. The hands are the ones that apply the direction on the ball in particular and not the force on it, only to a minimal extent (D'Anastasio et al., 2019).

5. The actual setting of the ball: it has reached the stage where the ball is in a downward trajectory, the body is positioned just below it, and it is observed that the ball has much rotation around its axis, in addition to the downward movement that we anticipate. At this point, in order not to make a mistake, namely double contact on the ball, much prior preparation is needed. The training is essential both for receiving, attack, and physical training and for the ball set. The palms are positioned in the form of volleyball, and the movement that the setter will perform is to push his hands towards the ball, thus canceling the effect received by the ball after reception of the ball. Therefore, the forearms should be bent at the elbow joint and positioned with the palms just above the forehead, with the thumbs oriented parallel and opposed to the eyes of the setter who will set the ball to his attacking colleague. A rapid movement positions the body under the ball's downward trajectory resulting from receiving the ball with the hands positioned so that if it did not hold them in this position, the ball would hit the setter exactly in the forehead.

6. Target zone: First of all, related to this aspect, we have to determine which the targeted area for setting the ball is. The easiest way to pass the ball is in front, hoping that the teammate also synchronizes with the ball and moves properly for the attack. As the game level increases, the setter must reach the stage where he can accurately set the ball both forward and backward, sideways, by jumping or in any way that serves his teammate effectively for his team. In principle, the ball must reach a trajectory parallel to the net at a distance of about 0.5m - 0.75m in front of the attacking teammate.

If the attacking player is left-handed and plays on the left side of the court, the setting for him must be in the position where he is or a little to the outside, but not to the inside of the court as his chances of attacking the ball from the setting decrease dramatically. If the attacker is right-handed and plays on the left side, that is considered his substantial area the setting can be sent without problems either in

front of the attacking player or further inwards if it cannot be entirely controlled, but not outwards.

It is much easier to attack an attacker who is on his strong side if the setting is more inwards than outwards. In the mirror, if we have a left-handed player who plays on the right side (his strong side), he adapts more quickly to a ball that comes inwards than one that passes him, and the trajectory carries him outwards. If a player activates on his weak side (a right-hander on the right or a left-hander on the left), the pass must be set either in front of them about the position in which they evolve or outside the antenna area.

Another important aspect concerns the setting's height and how it can be quantified in a well-defined way. Of course, we cannot give a very exact answer for this aspect, but it is clear that the ball, after being set, must rise at least 1 meter above the height of the net (if the players are close in that phase and the attacker can hit the ball before it falls below the top strip of the net). If the distance between the two teammates is considerable, the setting's height must increase considerably, and the ball should rise in the air at about 2 meters, as the attacker needs more time to reach the optimal position of attack and court orientation towards the opposing team. Both partners must start with the same thought, namely: it is never the setter's fault for a wrong attack. An attacker should adapt to any setting he receives from the setter, and in no way is he allowed to blame the coordinator. This should be noted because there is no framework in which the attacking player is immortalized in world-class tournaments when he blames the setter for the wrong setting. Billy Ashen, head coach at the University of California, said that "True attackers adapt to the setting regardless of its type".

Mental preparation in beach volleyball

Particular importance should be given to mental dispute in a game of beach volleyball. There are two types of mental disputes: the dispute between the two opposing teams and each player's dispute with himself. It is evident that in a sports dispute, whether it is a match in a competition or a simple, friendly match, all players want to win that dispute.

It is a behavior studied in many specialized works, and it is a majority concluded that no athlete likes to lose. Of course, there are no athletes who have not known defeat, but the way a player behaves when he loses or wins a game, a set or a point, differentiates them into two categories.

Experts believe that an athlete who is rational, sober in his actions, and mood externalizations and inner feelings have much better chances of progress, assertion, and long-term gain. When an athlete manifests himself in a pronounced way after winning a point, he expresses himself beyond measure, it is a sign that opponents often interpret as simple luck for him, and if he were to play that same type of attack or defense again, the chances of success would be lower. It puts the success to the sign of doubt and on the luck in such situations.

On the other hand, when one of the players expresses his frustration very openly after a point or a lost match, he is considered vulnerable by the opponents for the following actions and will try to take advantage of this aspect. Also, a very

vocal player, very exteriorized, is not very pleasant even by the spectators; they want to see a balanced and neutral person in behavior on the court regardless of the recorded result.

At a high level, in official FIVB, World Tour, or AVP competitions, this type of extreme behavior is sporadic, to the surprise of amateurs who observe so-called highly contested and won by individual players, to the surprise of fans they do not show their joy very obviously winning the point. This aspect is to be avoided by athletes and considering that every action of this kind is accompanied by energy consumption, which against the background of accumulated fatigue, and the difficult conditions in which this sport is played can make a difference.

Conclusions

Beach volleyball practiced from an early age opens up opportunities to practice volleyball, including in the gym in the coming years. More and more sports organizations and clubs are tempted to organize beach volleyball competitions, as the demands among athletes and spectators continue to grow with representation. Many specialists consider that a beach volleyball player can evolve in indoor volleyball and do it at a satisfactory level, but for an indoor volleyball player, it is not very easy to move to beach volleyball because the gym is far too specialized for each position. The best volleyball players started their careers on the sand and then switched to indoor volleyball. In other research with same interdisciplinary character highlighted the importance of children's psychomotor level (Szabo et al., 2020a) and the young population's health level (Szabo et al., 2020b; Szabo and Sopa, 2020a; Szabo and Sopa, 2020b).

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Kinematic angular analysis of cinematic biomechanics in forearm flexion: a case study

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Abstract: The research highlighted the importance of kinesiology and biomechanical analysis of movement in nowadays sports performance. Our case study followed a biomechanical structure of movement of forearm flexion and extension regarding angle, angular velocity, angular acceleration, tangential velocity, centripetal acceleration, resultant acceleration. As a research method, the Kinovea program, version 0.9.3., is used for biomechanical analysis using some specific kinesiological parameters of movement. The biomechanical movement results highlighted the specific forearm flexion and extension, showing the entire movement from a specific angle and speed.

Keywords: biomechanical movement, kinesiology, movement of the arm

Introduction

More generally, sports or physical activities positively impact life quality (Taborri et al., 2020). The benefits of life satisfaction, health, well-being, and educational and social participation have been shown by several studies (Bailey et al., 2015; Gilchrist and Wheaton, 2016). Also, perhaps due to the growing number of people who compete in various sports and recreational levels, the elite level requirements are continually increasing. Recent technological developments have contributed to these growing competitive levels, with these devices being used to monitor sports training and competition performance, particularly from sports biomechanics. The science of sports biomechanics provides quantitative (and sometimes qualitative) evaluations of sports

performance, particularly sports movements' kinematics and kinetics (Zatsiorsky, 2007). Measuring and characterizing human movements during sporting activities is crucial for coaching programs to evaluate athletes' performance, improve technique, and prevent injuries (Taborri et al., 2019; Lee and James, 2015; Kos and Umek, 2019). Biomechanics represents applying mechanical principles to living organisms, such as humans, animals, plants, and the basic functional units of life of cells. Biomechanics is now widely recognized to play an essential role in understanding the fundamental principles of human motion (Innocenti, 2018).

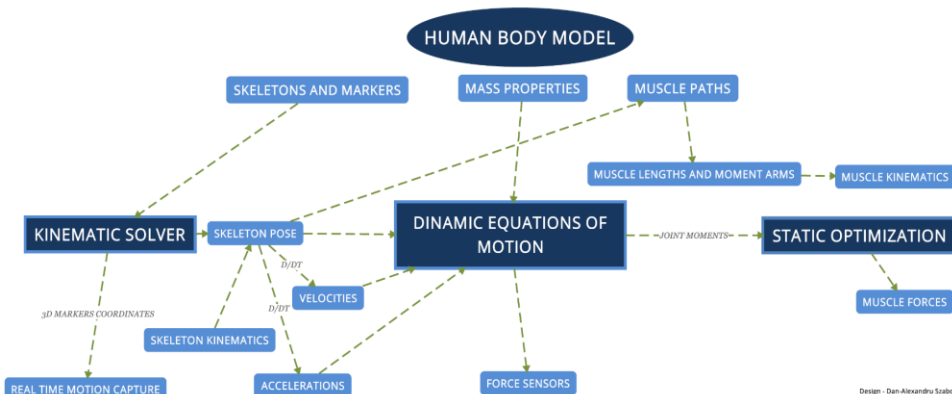


Figure 1. The human body model
(Source: Van den Bogert et al., 2013)

A separate modular organization has been revealed by locomotor networks, where the production from various interconnected supraspinal areas interacts with neuron assemblies located in the spinal cord to produce locomotor patterns and rhythms (Kiehn, 2016; Nordin et al., 2017). Spinal circuits show an amalgam of afferent links that appear to simplify the locomotor's function, given the difficulty associated with neural signal decoding. Rhythmic alternation during locomotion is enabled by relationships among the left section and right sections of the physique and among flexor muscle and extensors (Kiehn, 2016; Lanuza, 2004; Nordin et al., 2017). Commissural neurons with axons in the spinal cord's ventral part that cross the body's midline allow bilateral communication (Kiehn, 2016; Lanuza, 2004; Nordin et al., 2017).

Biomechanics analysis is also used for injury prevention, and three-dimensional motion analysis techniques evaluate joint kinematics and kinetics. These mechanical risk factors preceding ACL rupture can be used to analyze which athletes are most susceptible to injury before onset (Hewett et al., 2017); in particular, with 78 percent sensitivity and 73 percent specificity, knee abduction moment predicted ACL injury status (Hewett et al., 2005).

Human movement biomechanical analysis has become an essential instrument for introductory study and clinical treatment of orthopedic and neurological disorders (Van den Bogert et al., 2013). Traditionally, clinical movement analysis is carried out offline by processing raw motion and force data previously recorded; thus, the clinician who makes treatment decisions makes a laboratory or gait study. Biomechanical unpredictable time heritages such as joint curves (Kinematics) and

moments (Kinetics) are characteristically clinically significant knowledge in the statement (Van den Bogert et al., 2013). Musculoskeletal prototypes possess appeared employed in modern periods to provide further data about muscle length changes (Arnold et al., 2006) and muscle forces (Delp et al., 2007; Erdemir et al., 2007; Heintz and Gutierrez, 2007; Van den Bogert et al., 2013).

Employing real-time approximated specific variables, such as a particular joint curve (Barrios, 2011) or a particular joint moment (Shull, 2011; Van den Bogert et al., 2013), traditional implementations have appeared established for feedback preparation. Guesstimates that overlook particular mechanical consequences, such as inertial stipulations in the movement calculations, are often used to produce real-moment calculation plausible (Shull, 2011; Van den Bogert et al., 2013). Real time enterprise networks are presently restricted to kinematic elements (joint angles) (Barrios, 2011; Teran-Yengle et al., 2011; Van den Bogert et al., 2013), and perhaps joint moments muscle elements do not encompass them. Though curves and moments may be a helpful substitute for orthopedic or neurological rehabilitation-relevant substance loads and muscle employment, muscle-level analysis is necessary to fully understand (Delp et al., 2007; Erdemir et al., 2007; Van den Bogert et al., 2013). However, this is computationally demanding because, in favor of all muscles in a branch, or definitively, in the integrated body, muscle powers should be determined contemporaneously (Delp et al., 2007; Erdemir et al., 2007; Van den Bogert et al., 2013).

Methodology

Study Design and Subjects

The research protocol was explained, and the subject's informed consent for analyzing the results and publishing the paper was obtained. All the procedures have been carried out in compliance with the Helsinki Declaration's requirements.

This research started from the hypothesis that by using kinetic and biomechanical analysis software, Kinovea, version 0.9.3., we will improve the teaching process in the practical work on Biomechanics and Kinesiology discipline.

The study case focused on analyzing the arm's biomechanical angular movement on a student's forearm in the 1st year at the Master's program Physical Therapy and Functional Rehabilitation at the George Palade University of Medicine, Pharmacy, Science, and Technology from Târgu Mureș, Romania.

The purpose of this research was to highlight the fact that it can obtain some biomechanical data, such as angular kinematics, only with the help of video analysis software, without any other means of support.

All analyses were carried out in the framework of practical work in the Biomechanics and Kinesiology discipline, from 16-th September 2020 to 28-th September 2020, at the Discipline of Human Movement Sciences headquarters.

Procedure

Research protocol included several trials of execution of the arm's flexion on the forearm being registered the best and correct technical execution. The software used for analyzing the arm movement was Kinovea, version 0.9.3.

Results

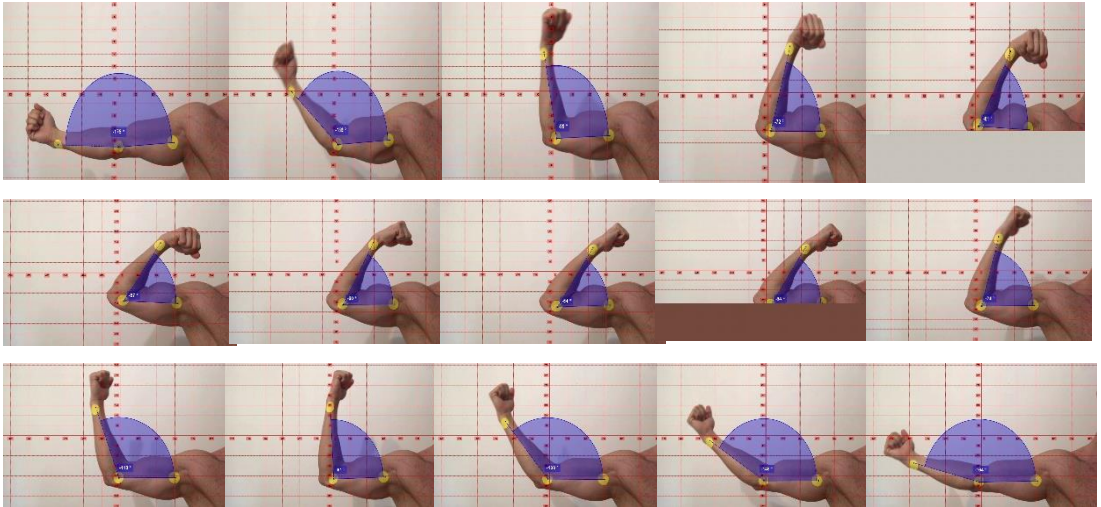


Figure 2. Graphical representation of angle variation in the forearm flexion and extension

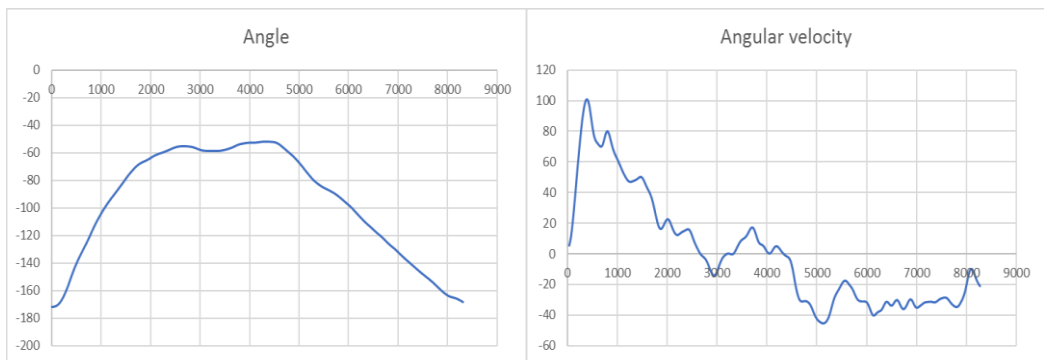


Figure 3. Biomechanical representation of angle and angle variation in the forearm flexion and extension

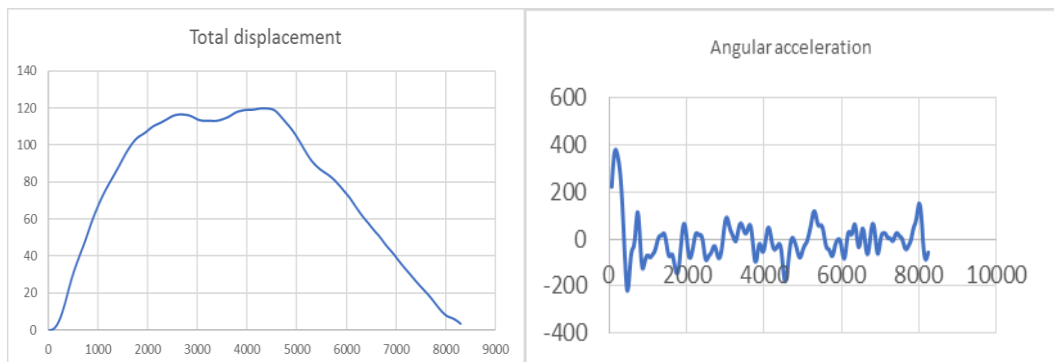


Figure 4. Representation of total displacement and angular acceleration in the forearm flexion and extension

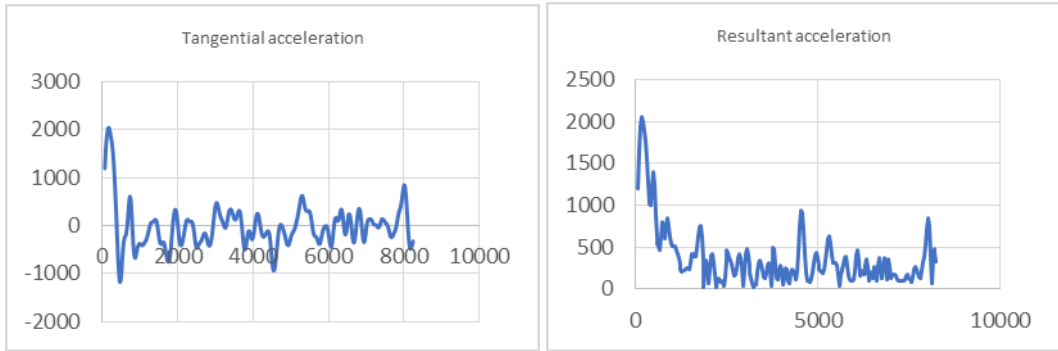


Figure 5. Biomechanical representation of tangential acceleration and resultant acceleration in the forearm flexion and extension

Table 1. Angular kinematics – from frame 0 to frame 2936

| Time (ms) | Angle | Angular velocity | Total displacement | Angular acceleration | Tangential acceleration | Resultant acceleration |
|-----------|----------|------------------|--------------------|----------------------|-------------------------|------------------------|
| 0 | -172.137 | - | - | - | - | - |
| 133 | -170.428 | 31.60931 | 1.70864 | 360.784 | 1945.261 | 1947.532 |
| 267 | -162.887 | 79.62643 | 9.249729 | 306.9687 | 1656.076 | 1760.399 |
| 400 | -150.228 | 100.7397 | 21.9092 | -53.3612 | -286.811 | 994.29 |
| 534 | -138.264 | 76.69962 | 33.87264 | -128.569 | -690.502 | 883.6697 |
| 667 | -128.611 | 70.02924 | 43.52572 | 4.533717 | 24.37134 | 460.7545 |
| 801 | -118.605 | 80.16132 | 53.53246 | -11.664 | -62.6137 | 605.2943 |
| 934 | -108.754 | 66.40366 | 63.38276 | -86.6033 | -463.857 | 620.5439 |
| 1068 | -100.544 | 56.58437 | 71.59334 | -76.7874 | -410.621 | 507.8463 |
| 1201 | -93.6089 | 48.20319 | 78.52818 | -39.5609 | -210.875 | 301.9869 |
| 1335 | -87.2971 | 47.84128 | 84.83995 | 14.15625 | 75.09749 | 224.8272 |
| 1468 | -80.7432 | 50.31888 | 91.39388 | -5.58731 | -29.475 | 234.9815 |
| 1602 | -74.4365 | 42.65355 | 97.70061 | -65.3074 | -342.302 | 380.6181 |
| 1735 | -69.4162 | 30.11858 | 102.7209 | -141.445 | -738.739 | 743.3527 |
| 1869 | -66.5811 | 16.21989 | 105.556 | -2.64719 | -13.8167 | 27.66335 |
| 2002 | -64.0052 | 22.63665 | 108.1318 | 7.69929 | 40.14199 | 61.52708 |
| 2135 | -61.4147 | 14.42313 | 110.7224 | -60.6634 | -315.641 | 316.2062 |
| 2269 | -59.7121 | 13.63339 | 112.4249 | 24.69449 | 128.3485 | 129.4512 |
| 2402 | -57.7211 | 16.01217 | 114.4159 | 5.786743 | 30.04185 | 37.97628 |
| 2536 | -55.9031 | 8.331842 | 116.234 | -84.0235 | -436.32 | 436.3657 |
| 2669 | -55.425 | -0.34564 | 116.7121 | -43.4067 | -225.5 | 225.5 |
| 2803 | -55.7691 | -5.69929 | 116.3679 | -71.1203 | -369.841 | 369.8528 |
| 2936 | -57.2127 | -14.2206 | 114.9244 | -4.88721 | -25.462 | 31.40778 |

Table 2. Angular kinematics – from frame 3003 to frame 5939

| Time (ms) | Angle | Angular velocity | Total displacement | Angular acceleration | Tangential acceleration | Resultant acceleration |
|-----------|----------|------------------|--------------------|----------------------|-------------------------|------------------------|
| 3003 | -58.118 | -11.3403 | 114.019 | 79.72296 | 415.5503 | 415.7149 |
| 3136 | -58.869 | -1.58346 | 113.268 | 36.1606 | 188.5327 | 188.5328 |
| 3270 | -58.8982 | -0.23029 | 113.2389 | -8.48763 | -44.2485 | 44.24855 |
| 3403 | -58.7842 | 4.35532 | 113.3528 | 65.99306 | 344.377 | 344.3814 |
| 3537 | -57.7283 | 10.01715 | 114.4088 | 24.39081 | 127.4696 | 127.7978 |
| 3670 | -56.0317 | 16.43253 | 116.1053 | 41.62065 | 218.25 | 219.6447 |
| 3804 | -53.9834 | 9.948826 | 118.1537 | -90.7949 | -477.498 | 477.5845 |
| 3937 | -53.1041 | 4.800391 | 119.033 | -42.0808 | -220.6 | 220.6102 |

| | | | | | | |
|------|----------|----------|----------|----------|----------|----------|
| 4071 | -52.8912 | 0.441131 | 119.2458 | 24.63083 | 128.9768 | 128.9768 |
| 4204 | -52.4479 | 4.869427 | 119.6892 | -13.417 | -70.4408 | 70.47431 |
| 4338 | -52.1216 | -0.26401 | 120.0154 | -32.3884 | -169.645 | 169.6453 |
| 4471 | -52.3762 | -4.50388 | 119.7608 | -85.9852 | -449.714 | 449.7179 |
| 4605 | -54.2854 | -25.5304 | 117.8517 | -132.56 | -694.397 | 696.949 |
| 4738 | -58.3106 | -31.0014 | 113.8264 | 5.066657 | 26.56834 | 91.8845 |
| 4872 | -62.5106 | -33.5646 | 109.6264 | -56.9794 | -299.15 | 316.4605 |
| 5005 | -67.6414 | -42.821 | 104.4957 | -43.8185 | -230.459 | 285.3802 |
| 5138 | -73.6064 | -45.5523 | 98.53069 | 6.696229 | 35.33688 | 194.355 |
| 5272 | -79.37 | -38.0456 | 92.76701 | 110.9864 | 587.4853 | 602.5126 |
| 5405 | -83.461 | -25.2656 | 88.67603 | 58.53458 | 310.8572 | 316.438 |
| 5539 | -86.3235 | -17.9921 | 85.81352 | 28.63462 | 152.4649 | 155.4043 |
| 5672 | -88.8084 | -21.0331 | 83.32869 | -43.0654 | -229.793 | 233.4575 |
| 5806 | -92.1285 | -29.3384 | 80.00856 | -49.8138 | -266.589 | 278.4485 |
| 5939 | -96.2482 | -31.2017 | 75.88885 | -0.75156 | -4.04148 | 91.46061 |

Table 3. Angular kinematics – from frame 6006 to frame 8308

| Time (ms) | Angle | Angular velocity | Total displacement | Angular acceleration | Tangential acceleration | Resultant acceleration |
|-----------|----------|------------------|--------------------|----------------------|-------------------------|------------------------|
| 6006 | -98.3335 | -31.897 | 73.8036 | -37.544 | -202.658 | 224.1829 |
| 6139 | -103.204 | -40.383 | 68.93275 | -9.15786 | -49.7895 | 162.5584 |
| 6273 | -108.388 | -37.3701 | 63.74954 | 22.72365 | 124.1669 | 182.0866 |
| 6406 | -112.955 | -31.3343 | 59.18236 | -0.88497 | -4.85405 | 94.11731 |
| 6540 | -117.363 | -32.676 | 54.77401 | 43.74184 | 240.4509 | 261.3625 |
| 6673 | -121.509 | -33.3765 | 50.62822 | -64.0146 | -352.394 | 368.2891 |
| 6807 | -126.238 | -33.4158 | 45.8989 | 64.20477 | 354.3843 | 370.3503 |
| 6940 | -130.342 | -32.4549 | 41.79465 | -62.2477 | -344.949 | 359.6786 |
| 7074 | -134.971 | -34.0225 | 37.16562 | 24.97516 | 138.7733 | 178.4919 |
| 7207 | -139.304 | -31.5645 | 32.83353 | 4.015261 | 22.37262 | 99.43923 |
| 7341 | -143.5 | -31.7465 | 28.63708 | -5.31895 | -29.7089 | 102.6427 |
| 7474 | -147.64 | -29.5056 | 24.49726 | 18.14091 | 101.5564 | 132.4734 |
| 7608 | -151.486 | -28.9206 | 20.65128 | -21.0366 | -118.052 | 143.6908 |
| 7741 | -155.678 | -33.8561 | 16.4586 | -25.7328 | -144.891 | 183.5267 |
| 7875 | -160.266 | -32.6187 | 11.87073 | 53.78155 | 303.3519 | 320.9259 |
| 8008 | -163.942 | -19.5545 | 8.195448 | 150.6024 | 849.2695 | 850.103 |
| 8141 | -165.565 | -11.5236 | 6.571844 | -67.7753 | -381.362 | 381.5848 |
| 8308 | -168.557 | - | 3.580481 | - | - | - |

Discussion

Sports biomechanics is now generally carried out using wearable sensors that enable non-invasive data acquisition during motion execution (Taborri et al., 2016). Besides, wearable sensors enable sporting activities to be carried out in the natural environment, overcoming laboratory tests' environmental constraints, such as using the optoelectronic 3D system, which is still considered the gold standard for motion analysis (Taborri et al., 2016; van der Kruk and Reijne, 2018). Inertial sensors (Lee and James, 2015; Kinnunen et al., 2019; Gopfert et al., 2017), force sensors (Lee et al., 2017; Buckeridge et al., 2015; Kos and Umek, 2018a), and electromyography probes (Brochner et al., 2018; Cruz Ruiz et al., 2015) are commonly used to quantify kinematics, kinetics, and muscle activity objectively and unobtrusively during sports activities. One promising direction in using wearable sensors is real-time biofeedback systems (Kos and Umek, 2018b) that can provide athletes and/or coaches with simultaneous augmented feedback information (Kos and Umek, 2019; Umek and Kos, 2016; Kos et al.,

2019). To perform advanced experiments that gave a much better understanding of joint kinematics and tissue function during walking, running, and other daily living activities, more sophisticated equipment and analyses were available (Innocenti, 2018).

Investigation in motor control was previously restricted to lab-established evaluations of specific neurons, muscles, or joints, grabbed from insignificant sampling. In the heritage, the practicability of considerable size, the multivariate investigation was legitimately constrained by overreliance on massive, expensive, outside broadcast gadgets, such as optic motion capture networks (Nordin et al., 2017). Today, full-body kinematic recordings are becoming increasingly common, employing body-sported inertial determining divisions, cordless electromyography (EMG), electroencephalography (EEG), and operational near-infrared spectroscopy (fNIRS) networks, and electrode assortments for neural system broadcasts (Nordin et al., 2017).

Some research indicated that for the 2.5 to 3 seconds of a more extended test, muscles that can hold an isometric contraction for a short time could not retain the contraction (Conable, 2010). "Because many examiners in practice use tests of 1 second or less (Vasilyeva, 2004), muscle weaknesses that develop later may be missed, with the differences observed being possible (differences in duration of tests may well be between" patient-started "and" examiner-started "tests).

In clinical movement analysis, muscle contraction kinematics and muscle force analysis are not yet well established, but there are considerable advantages. In surgical planning for cerebral palsy patients, information about muscle length changes during gait can help (Arnold et al., 2006).

Conclusions

The study's hypothesis has been confirmed, and by using kinetic and biomechanical analysis software, Kinovea, version 0.9.3., it was improved the teaching process in the practical work on Biomechanics and Kinesiology discipline.

Also, the students' feedback was positive, and by merely using Kinovea software, it was able to translate into practice the concepts accumulated in the course, notions about biomechanics, kinesiology, and angular kinematics (angular velocity, total displacement, angular acceleration, tangential acceleration, resultant acceleration).

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Dual career (profession and sport) in academic system - a premise for the existence a regular university football championship in Romania

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Abstract: University football has tradition in the Romanian political context. The first teams that made history in amateur and later professional football were founded in the early twentieth century by students who returned to the country after completing their studies abroad. Through this study, based on the experience in already traditional championships such as the British one, we propose a strategy for implementing such a dual system based on professional development and sports in the Romanian academic environment. The existence of 93 public and private universities (in 2020)² with own specific infrastructure, 22 university centers and about 0.4 million students provide a "fertile ground" for such approach, for competitions with male and female teams. Through specific methods in the field of territorial planning and geography this study presents: the competitive design, the implementation strategy, human resources, infrastructure, spatial models with systemic functionality, etc. Sport in general and football in particular have proven to be the most effective ambassadors of a community, nation or institution etc.

Keywords: universities, students, university football, university championship, national university league, university football in Romania

Introduction

The idea of a functional systemic construction of a national university football championship in Romania has been germinating in the university environment for a long time as evidenced by the tournaments organized sporadically in the last 40 years. Either at university centers or at national level, inter-university football competitions existed both during the socialist period and after (Buhaș et al., 2017), especially in the last decade. If before 1990 a national competition with

international participation entitled "Universiade" was organized, in the last decade, thanks to the Federation of School and University Sports and with the support of the Romanian Football Federation, 5 editions of the national university football tournament were organized¹. It is to be noted the contribution of 27 participating universities from 16 universities center and especially the role assumed by the organizer of the Polytechnic University of Timisoara (editions: 2015, 2017 and 2019) and *Babes-Bolyai* University of Cluj-Napoca (editions 2016 and 2018). Currently, there are 93 public and private universities in Romania that can provide the necessary human resources and, most importantly, most of them have their own specific infrastructure (Dragoș, 2015).

In this study we present the favorable premises for such an approach, the operating framework, the human resources and infrastructure and a functional competitive system model. All the aspects presented are supported by an adequate and suggestive graphic and cartographic representation.

The basic idea is to make the university environment even more attractive by promoting dual career (Aquilina and Henry, 2010; Guidotti et al., 2015; Ilieș and Caciora, 2020) "the dual form of university life based on continuing to practice a sport in an organized way, in parallel with university professional training" (Oros and Hanțiu, 2018). Inspired by the British model with long experience³, such a functional territorial system can be successfully implemented in the Romanian university environment as well based on a well-founded scientific and economic strategy. Moreover, the organization involves both men's and women's competitions.

Methodology

The establishment of a functional database, with up-to-date information from credible primary sources (universities in the first place), represents the first stage of this approach. The next step is to manage this database through GIS, a modern tool for managing statistical data (Robinson et al., 2017) and images, especially suggestively through complex cartographic materials expressively realized. One of the advantages of this tool is that it is constantly updated, which is also reflected in the diversified range of cartographic products created (Ilieș et al., 2015a; O'Brien and Cheshire, 2015; Ilieș et al., 2016a; Murphy, 2019; Ilieș and Caciora, 2020). The advantage of this tool also derives from the fact that it is constantly updated, which is also reflected in the diversified range of cartographic products made. The methods of representation and spatial analysis (Cartwright and Sørensen, 2009; Ilieș et al., 2016a; Dehoorne et al., 2019), specific to the geography of sport (Bale, 2003; Conner, 2014; Ilieș et al., 2014; Chirazi, 2019) and territorial planning, facilitate quantitative and qualitative spatial analyzes (Caput-Jogunica et al., 2012; Candello et al., 2019; Bulz and Ilieș, 2017; Gartner and Huang, 2016), the use of indicators, the creation of typologies etc. An important role is played by the spatial transposition that facilitates a better understanding of the systemic functioning mechanisms of a sports competition (Buhaș, 2015) and of the systemic "puzzle" formed by the dynamic component: human resource and the static resource: the infrastructure (Augustin, 2007; Ilieș et al., 2015b; 2016b; Graczyk et al., 2017; Olszewski-Strzyżowski, 2018).

The analytical framework

In Romania, with a population of about 21 million inhabitants, there are 22 university centers that host the headquarters of 93 public and private universities. In the academic year 2019/2020 there were about 0.4 million students distributed in 55 state universities (0.35 million students) and 38 private universities (about 55,000 students). To the university centers that house the main headquarters of the universities are added another 28 university centers, in urban localities of different sizes which host branches of the mentioned universities².

The data presented are favorable indicators in order to establish a regular university sports movement on the football branch that can be extended to other sports as well (Herman et al., 2018; Lucaciu, 2018). The "fertile land" of the Romanian university environment also results from the comparison with the Scottish part of the British integrated system: *Scotland with 5.454 million inhabitants, with 19 universities, about 231,000 students. In the 2019/2020 season, 15 universities participated in parallel in 5 university competitions (one championship and 4 cups) with 75 university football teams (+7 colleges) organized on 7 levels (7 leagues) but also in Scottish amateur football competitions (leagues 3 and 4). Around 1855 students practice football in an organized way and on a regularly basis, being legitimized at 19 clubs with women's teams (525 players) and 53 with men's teams (1330 players). The universities of Edinburgh and St Andrews are enrolled in men's and women's university competitions with 9 teams each (Ilieș and Caciora, 2020). We mention that the Scottish teams are part of a 9-tier UK university championship system, which includes over 1,000 men's and women's teams*³.

In these conditions, this study tries to provide a practical answer to the question why football should neglect this educated segment (Böheim and Lackner, 2012) and which can more easily understand and promote the importance of sport for health and life?, especially since the athlete is the best international ambassador and sport is the mirror of a nation, community (Rotar and Ursu, 2019; Kijewski and Wendt, 2019).

"Reinventing" the national university championship

After the fall of the socialist system several sporadic attempts to resurrect university football competitions were undertaken. Unfortunately, only recently has been ensured the continuity through the last 5 editions of the National University Football Championship of Romania, men, consecutively held under the auspices of the Federation of School and University Sports in partnership with the Romanian Football Federation. Unfortunately, the sixth edition, with a final tournament scheduled in Oradea, did not take place due to the COVID-19 pandemic. The last 5 editions of the National University Football Championship of Romania, where the interest was shown by the number of participating institutions, by the way of organization, by the human resources involved, by the way of institutional involvement in organization and participation, by the way in which the competition and the participating universities were promoted at sports level, through the image created for the Romanian university sport following the participation of the Romanian champion in the European competition etc, are arguments that encourage us to theoretically and practically complete such an approach.

The "directors" on which the restart of the university championship in the third millennium was based on had optimistic and substantial messages, and the evidence is their support and involvement in all 5 successive editions developed so far. Only the COVID19 pandemic caused the sixth edition scheduled in Oradea to be postponed. Only the COVID-19 pandemic situation postponed the sixth edition planned to be held in Oradea. The Director of the Competition, the journalist Stăncioiu Octavian, optimistic since the first edition of this project, claimed that *Elitist by definition, the university environment may contribute decisively to the revitalization of Romanian football*¹ (Stăncioiu, 2015). Through the director's message, FSSU, the main partner, stands for the importance of the university football and sustains that *This project confirms us, through the reciprocity system promoted and agreed by the participating universities, that sport remains an essential element in university life, meant to increase the bio-psycho-motor potential of students, to develop their associative life and respect for rules in order to increase the degree of socialization... We also aimed to increase the internationally prestige of Romanian universities also through sports. The winning university will represent our country at the European University Football Championship*.¹ (Georgescu, 2015). Ciprian Paraschiv reinforces the above-mentioned words and states that *For the first time, the Romanian Football Federation is involved in organizing a National University Football Championship in 11 players and I am convinced that this event is only the first page of a beautiful collaboration*¹ (Paraschiv, 2015). As the host of the first tournament in 2015, the Rector of the Polytechnic University of Timișoara, prof. Viorel Șerban, one of those who contributed to the post-December *student football renaissance*¹ of the Polytechnic of Timișoara predicted the continuity of university sports, claiming that *I am confident that this project - and those that will follow in this format - will give a signal to public opinion, perhaps a modest one for now, on what can and should a University be in society nowadays. The voice of universities must be heard, society must receive a signal thing can be done differently, that the natural and healthy state is that of normalcy, of cultivating human solidarity, and of hope for the better*¹ (Șerban, 2015).

Through this study we want to offer a theoretical support with practical applicability to continue and develop the activity of the representatives of the institutions that organized the previous editions. We refer to the host institutions of the final tournaments (figure 1): Polytechnic University of Timișoara - 2015, 2018 and 2019 editions, Babeș-Bolyai University of Cluj-Napoca, 2016, 2017 editions and to the 27 participating universities from 15 university centers: December 1, 1918 University of Alba Iulia (1D1918.U); from Arad (2): Aurel Vlaicu University (AV.U) and Vasile Goldiș West University (VGW.U); Transilvania University of Brașov (T.U); from Bucharest (5): Alexandru Ioan Cuza Police Academy (AIC.P.A), Ecological University (E.U), National University of Physical Education and Sports (NUPES), Polytechnic University (P.U) and University of Agronomic Sciences and Veterinary Medicine U.ASVM); from Cluj-Napoca (3): Babeș-Bolyai University (BB.U; champion in 2016 and 2018); University of Agronomic Sciences and Veterinary Medicine (U.ASVM) and Technical University (T.U); from Iași: Alexandru Ioan Cuza University (AIC.U), Grigore T. Popa University of Medicine and Pharmacy (GTP.MP.U) and Gheorghe Asachi

Technical University (GAT.U); University of Oradea (Oradea U.); University of Petroșani (Petroșani U.); University of Pitești (Pitești U.); *Lucian Blaga* University of Sibiu (LB.U); *Valahia* University of Târgoviște (V.U); *Constantin Brâncuși* University of Tg Jiu (CB.U; champion in 2015); *Petru Maior* University of Târgu Mureș (PM.U); from Timișoara (3): *West* University (W.U; champion in 2017 and 2019), Polytechnic University (P.U) and *Ioan Slavici* University (IS.U).

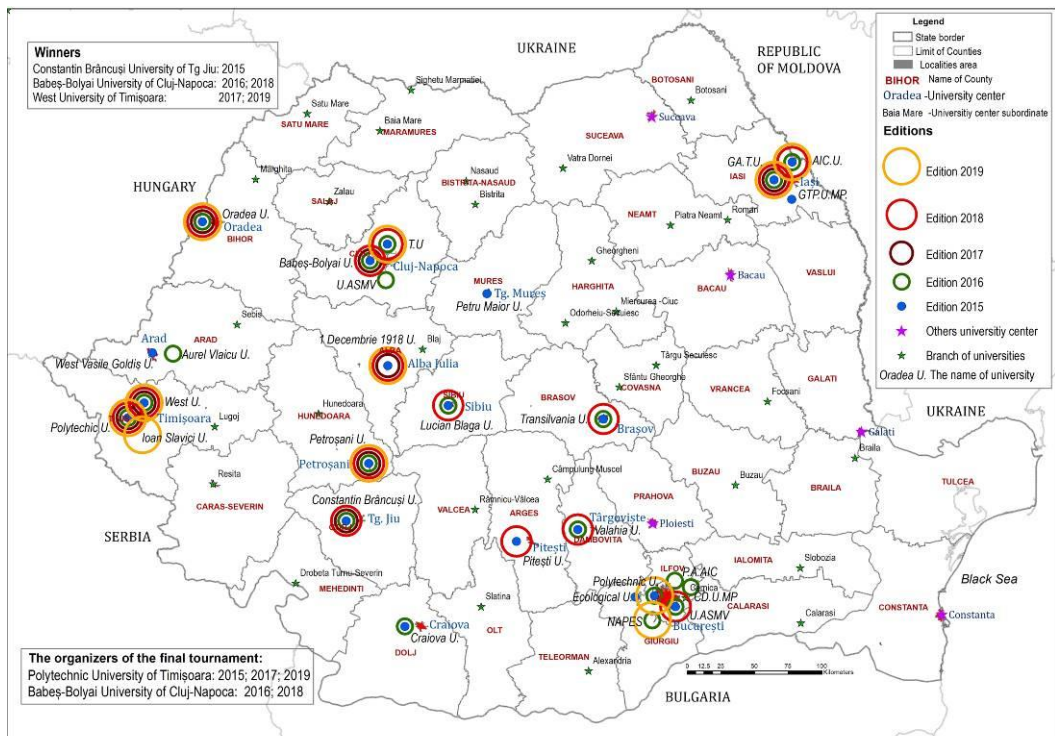


Figure 1. Universities participating in the 5 editions of the National University Football Championship of Romania^{4; 5}

The champions participating in the European competition achieved the following performances^{1;5}: edition 2015, Osijek (Croatia) 2015, 5th place: *Constantin Brâncuși* University of Tg Jiu; edition 2016, Zagreb and Rijeka (Croatia), 8th place: *Babeș-Bolyai* University of Cluj-Napoca; edition 2017, Porto (Portugal), 9th place: *West* University of Timișoara; edition 2018, Coimbra (Portugal), 9th place: *Babeș-Bolyai* University of Cluj-Napoca; edition 2019, Madrid (Spain), 9th place: *West* University of Timișoara.












Tradition and professionalism





At the level of 2020, in amateur and professional football in Romania (Herman et al., 2016), there are 17 sports clubs with football teams that are established by higher education institutions.

A.) In 2020 (figure 2; table 1), in professional and amateur football championships^{6,7}, there are 16 university clubs and associations with 22 women's (7) and men's (15) football teams connected with higher education institutions or are in such a partnership (Ilieș et al., 2015b).

B.)



Table 1. The Associations and clubs with women's and men's football teams connected with higher education institutions in professional and amateur leagues^{6,7}

| no | Club logo | Supporting university and teams | since | National professional league | | | Amateur regional and local leagues | | | | |
|----|---|--|----------------|------------------------------|---|---|------------------------------------|---|---|---|--|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 1 |  | -CSU Universitatea Craiova 1948 is supported by the University and the the Mayor's Office of Craiova; -The club has two men's teams: in the 1 st and in the 2 nd leagues. | (1948) 2013 | | | | | | | | |
| 2 |  | FC Politehnica Iași is supported by the Gheorghe Asachi Technical University and the Mayor's Office of Iași; -The club has one men's team in the 1 st league. | (1945) 2010 | | | | | | | | |
| 3 |  | FC Universitatea Galați is supported by the Dunărea de Jos University of Galați; -The club has 2 women's teams in the 1 st and in the 3 rd leagues; | 2015 | | | | | | | | |
| 4 |  | -CS Universitatea Alexandria is supported by the Mayor's Office of Alexandria; -The club has one women's team in the 1 st league | 2012 | | | | | | | | |
| 5 |  | -FC Universitatea Olimpia Cluj-Napoca is supported by the Babes-Bolyai University and CS Universitatea Cluj-Napoca; -The club has 2 women's teams in the 1 st and in the 2 nd leagues; -The team won the title of Champion of Romanian in 9 editions (2011-2020) | 2010 | | | | | | | | |
| | | FC Universitatea Cluj-Napoca is the result of the association between 4 universities and the Mayor's Office of Cluj Napoca; -The club has one men's team in the 2 nd League. | 1919 | | | | | | | | |
| 6 |  | -ASU Politehnica Timișoara is supported by the Polytechnic University of Timișoara; -The club has two men's teams in the 2 nd and in the 7 th leagues. -The club has one women's team in the 3 rd league | 2012 | | | | | | | | |
| | | | 2018 | | | | | | | | |
| 7 |  | -The club FC Ripensia UVT Timișoara is in partnership with the West University of Timișoara; -The club has one men's team in the 2 nd league. | (1928) 2012 | | | | | | | | |
| 8 |  | -ACS Student Sport Alba Iulia (L2) is supported by the 1 Decembrie 1918 University and the the Mayor's Office of Alba Iulia; -The club has one women's team in the 2 nd league | 2018 | | | | | | | | |
| 9 |  | ACS Unirea Politehnica București is supported by the Polytechnic University of Bucharest; -The club has one men's team in the 4 th league Bucharest | 2018 | | | | | | | | |
| 10 |  | AS FC Universitatea Oradea is supported by the University of Oradea; -The club has one men's team in the 4 th league Bihor County | 2011 | | | | | | | | |
| 11 |  | -CS Universitatea 1 Decembrie 1918 Alba Iulia is supported by the December 1, 1918 University of Alba Iulia -The club has one men's team in the 4 th league Alba County | 2018 | | | | | | | | |

| | | | | | | | | | | |
|----|---|---|------|--|--|--|--|--|--|--|
| 12 |  | CS Universitatea de Vest Timișoara is supported by the West University of Timișoara; -The club has one men's team in the 4 th league Timiș County | 2018 | | | | | | | |
| 13 |  | -CS Universitatea Petroșani is supported by the University of Petroșani; -The club has one men's team in the 5 th league Hunedoara County | 2009 | | | | | | | |
| 14 |  | -AMEFA Cluj Napoca has support of the students of the universities of Cluj-Napoca; -The club has one men's team in the 5 th league Cluj | 2015 | | | | | | | |
| 15 |  | -ACS Sportul Studentesc Iași is supported by the students of the Iași university center; -The club has one men's team in the 5 th league Iași | 2016 | | | | | | | |
| 16 | | AS Poly 2014 is supported by the students of the Iași university center; -The club has one men's team in the 5 th league Iași | 2014 | | | | | | | |

Other football clubs with names inspired by university brands are active in Romanian football professional leagues in Timișoara and Craiova (figure 2; table 2)^{6;7}

Table 2. The men's football teams inspired by the university brands active in professional leagues in Romania^{6;7}

| no | Logo | Supporting university | since | professional league | | |
|----|--|--|----------------|---------------------|---|---|
| | | | | 1 | 2 | 3 |
| 1 |  | -ACS Politehnica Timișoara (activated in national league) is supported by the local authorities in Timiș County. -The club has one men's team in the 3 rd league. | (1921) 2012 | | | |
| 2 |  | -FC Universitatea 1948 Craiova, without connection with the higher education institution, but which claims to be the continuator of the university club. It is 100% private club. -The club has two men's teams in the 2 nd and in the 3 rd national leagues. | 1948 | | | |

After the fall of the socialist system (1990), 5 university clubs were temporarily active in Romanian football (figure 2; table 3). In 2017, one year after the centenary (1916-2016), the oldest and one of the most performing student football clubs in Romania, Sportul Studentesc București, disappeared^{6;7}.

Table 3. The men's football teams connected with higher education institutions in professional and amateur leagues were temporarily active after 1990 (exception FC Sportul Studentesc)^{6;7}

|  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|--|---|
| FC Sportul Studentesc București (L1) (1916-2017) | ACS Universitatea Dunărea de Jos Galați (L3) (2017-2020) | CS Universitar Voința Sibiu (L1) (2007-2012) | FC Maramureș Universitar Baia Mare (L2) (2010-2013) | Atletic Club Universitar Arad (L2) (1995-2011) | FC Politehnica Timișoara (L1) (1921-2012) | FC Știința Bacău (L2) 2008-2009 | CS U-Nord Baia Mare (2003-2009; (L4 Maramureș) |



The only professional football team (league 3) administratively related to a high school (Cetate National Sports College) was, in the period 2013-2020, CNS Cetate/LPS Cetate Deva. From 2020 became CSM Deva and passed into the administration of the Mayor's Office of Deva⁸.

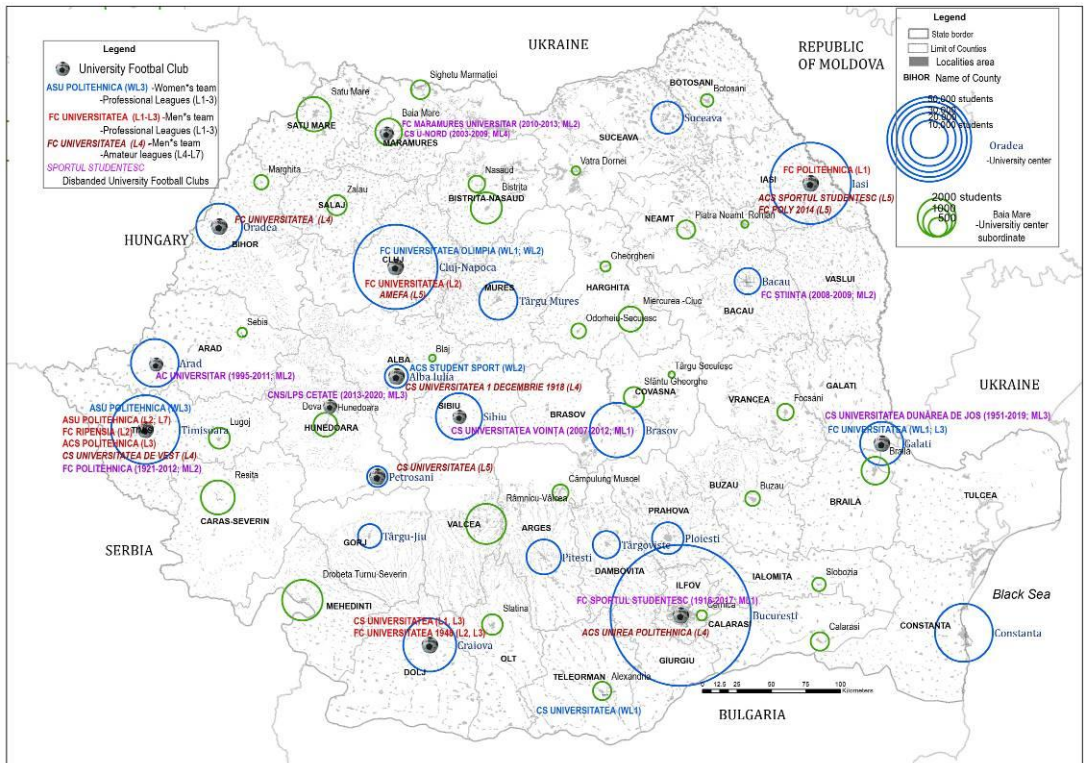


Figure 2. University sports clubs / associations with football teams participating in professional (Leagues 1-3) and amateur (leagues 4-7) competitions in Romania^{6; 7}

Why a national university football league?

The implementation of dual university models in Great Britain, USA, Portugal, Spain, Germany, Russia, China, South Africa, Canada etc. demonstrates through their success the importance of the connection between sports in general and football in particular and university professional training (Reilly and Gilbourne, 2003; Tight, 2002; Donnor, 2005; Humphreys, 2006; Gayles and Hu, 2009). In Romania, for example, the name "University" in Craiova will remain for a long time with priority related to the football team in the national collective mentality, compared to the higher education institution that was the basis for its establishment in 1948.

The main purpose of establishing a national university football league has the following objectives:

- increasing the institutional visibility at the highest level, sport being the most important ambassador or means of promotion on any level and in any field;
- increasing the degree of social integration of the institution in the daily life of the university but also at regional level (Kozma, 2014; Kozma et al., 2015);
- promoting and implementing the dual concept of professional training and sports (profession and passion) with multiple advantages for young people who were enrolled in performance sports during their junior age (up to 18 years).
- promoting and efficient use of its own infrastructure, in most university campuses there are homologable grounds for football competitions in 11 (fig.3).



Figure 3. Football fields in Romanian universities campus

In the case of Romania, the brands *Universitatea (University)*, *Politehnica (Polytechnic)*, *Știința (Science)* or *Sportul Studentesc (Students Sports)*, regardless of the level of competition, remained the first option in the collective mind of the city. A good example is the fact that in Cluj Napoca, the *CFR 1907* club, with all its European and national performances, cannot overcome the popularity gap of the fellow-club *FC Universitatea. Politehnica (Polytechnic)* remains the first option for the people of Timișoara (Crețan, 2019), even if traditional clubs like *Ripensia* have (re)appeared; for Craiova there is no other name, they rather accept that all the teams from Craiova be called *Universitatea (the University)* etc., and in Iași, after many attempts to rebrand, the traditional name *Politehnica (Polytechnic)* has returned.

Pro-social arguments

Along with increasing the attractiveness of the university environment by implementing and supporting a dual system, there are numerous social and psychological arguments that support the continuation of higher-level personal development (Christensen and Sørensen, 2009; Aquilina and Henry, 2010; Candello et al., 2019; Böheim and Lackner, 2012; Dragoș et al., 2019). Among these we mention:

-Reducing the rate of premature dropout of sports activity among young people, especially of those between 16-18 years;

-The decrease in the lack of a life perspective generated by the football practiced in the youthful period;

-According to the already successful models: Australia¹² USA, Canada¹³, Great Britain, China, Spain (de Subijana et al., 2015), Poland (Graczyk et al., 2017), South Africa (Tshube and Feltz, 2015 etc.), the encouragement of university sports offers

“an extra chance” for a young person at a young age in the situation of choosing between a job, continue studies or continue sports life.

-Decreasing “critical” situations in the case of pandemics (such as the current one, COVID-19), when sports activity is interrupted for an indefinite period and most young athletes are left without financial resources. Implicitly there is a negative psychological impact generated by the lack of sports perspective, especially in semi-professional football (L2-L3). In the case of university sports the educational alternative offers the perspective of higher qualification profession and the possibility to continue football at amateur or even professional level (by transfer or activating in parallel to an L1-L3 team).

-The perspective for young people (between junior and senior period) to continue their sport life in parallel with a professional training at high school and university level. Following the British or American model (and not only) high schools (especially LPSs) and universities can offer this extra opportunity to young people.

-Unfortunately, a large part of those who reach the age of juniors A (17-19 years old) do not have a sports perspective, more precisely after many years of training they find that their sports horizon is closing. In these cases, for most of them, the chance to activate and continue sports performance at university clubs comes with multiple advantages such as: sports scholarships and merit scholarships, free accommodation in dormitories, sports equipment, awards, access to multiple sources of information; pedagogical and psychological training etc.

-Sport remains the most effective form or tool for promoting an institution: *Universitatea/Politehnica* are brands that, even if associated with traditional university centers in Craiova, Cluj, Iași or Timișoara, have become famous through sports (especially team sports) and football in particular.

-A large number of young people in the final high school classes can be stimulated by the perspective of performing at a university club to obtain their baccalaureate diploma and understand its importance in their lives.

-Sports scholarships can be stimulating for future students;

-By professional support given to university clubs, a large number of young people can continue their sports life for a period of 3 to 8 years (3 years bachelor + 2 years master + 3 years doctorate), and by continuing their training in sports they can perform also in their sport branch;

-Universities benefit from specialists in combating school dropout and especially in psychotherapy.

The advantages of having a regular university competition may generate:

-Institutional visibility for universities at the highest level and implicitly increasing the interest for the establishment of university associations/clubs (British and American model);

-The possibility of accrediting specialization programs within an FRF-Universities partnership with an emphasis on athletes who choose the dual option sport-education and for personal development;

-Attractiveness for sponsors and mass media;

- Substantially low costs compared to amateur and professional football competitions;
- Flexible competitive calendar;
- European competition calendar through EUSA and European and World university tournaments;
- Possibility of concluding mutually beneficial collaboration agreements or partnerships between university clubs and those in professional leagues, as a basis for selection for groups under 23, 21, 20, and 19.
- High level of personal development for the student athlete;
- Decreasing the dropout rate of sports activity in the age range of 16-19 and especially of that over 19 years;
- Increasing the visibility and social insertion of the university and of the university sports club at local, regional and national level;
- Increasing the importance of the sports partnership through a new competition and attracting the existing University Sports Clubs (USC) in these competitions.

Simulation of functional systemic models for organizing university football

The simulation of an organizational model involves a careful analysis of all endogenous (specific to higher education institutions) and exogenous factors (referring to the local, regional and national environment of competitions).

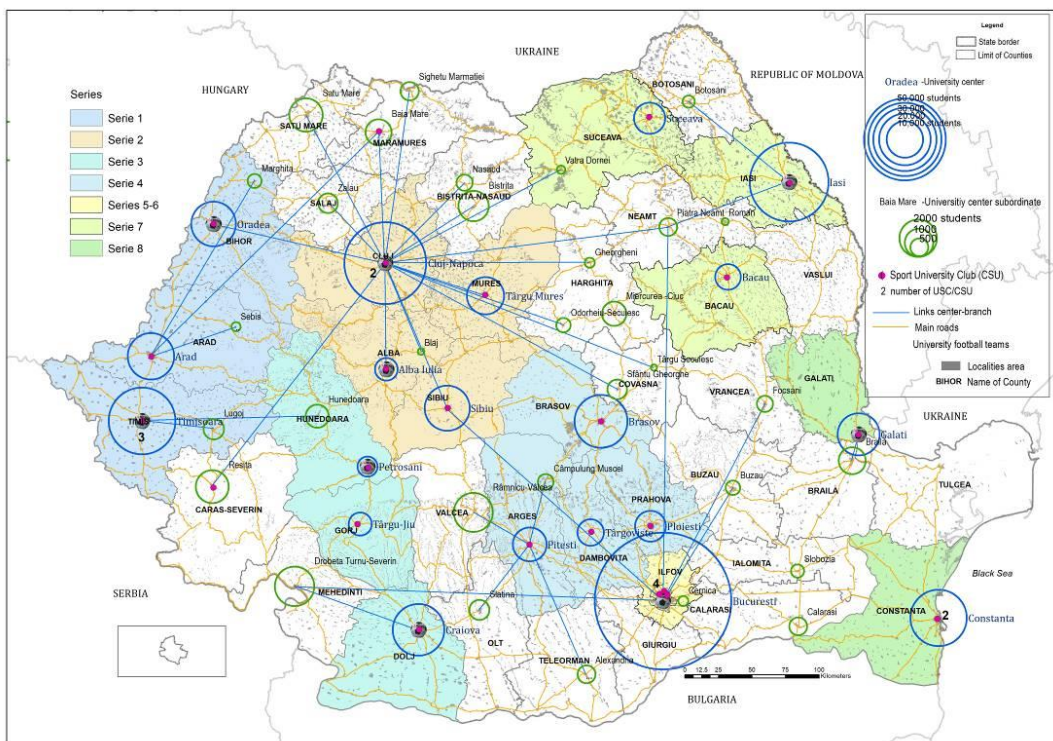


Figure 4. Version 1. Proposal for the organization of the national university football league in Romania on 8 series constituted on the criterion of geographical proximity²

Based on the geographical criterion, we propose an initial competitive system with 8 series based on the presence (theoretical/hypothetical) of public universities, associations/university sports clubs (other than USC/CSU) and of all 27 USCs. Depending on the affiliation of other private or public universities (including university branches) the number and composition of the series may change. Universities from Bucharest, depending on the number of registered teams, can form two series or a series with two groups.

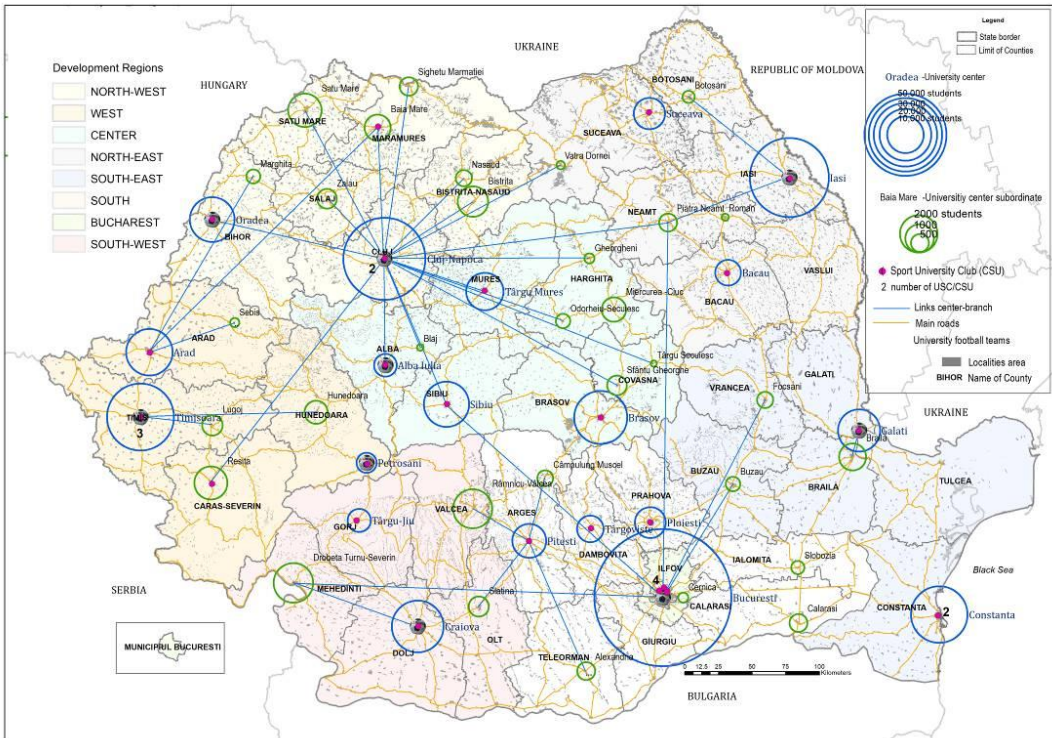


Figure 5. Version 2. Proposal for the organization of the national university football league in Romania on 8 series based on the 8 development regions²

Depending on the number of affiliated university sports associations, the territorial structures can be adapted by the efficiency on all levels.

This project was sustained also by the University Amateur Football Association of Romania (UAFAR/AUFAR), with its headquarters in Oradea, and which aims to manage university football competitions in Romania in partnership with FRF and SUSF/FSSU.

Version 1 of geographical proximity, at theoretical level it configures 8-10 series, the main criterion being geographical proximity and economic and temporal efficiency (figure 4).

Version 2 by development regions, which involves 8 groups to which two other groups from Bucharest university center can be added (figure 5).

Conclusions

The establishment of a national football university league capitalizing on the network of higher education institutions in Romania (93 institutions) with the human resources, infrastructure and own Romanian expertise, the experience of traditional competition systems such as the British one (bucs), can increase the attractiveness of the Romanian academic system multiplying its curricular and extracurricular offer. Thus: high school graduates who have practiced performance football have an extra chance to continue sport in an organized way (3+2+3 years), in parallel with an academic professional training as an alternative for the post-sportive period to come; every sports student has an opportunity in sports and at the same time a quality education, a mentality specific to strong characters. Sports in general and university football in particular promote the idea that a valuable education (sports and profession) has major benefits for a young person who chooses a dual career: education and sports. Attracting and integrating young people into academia and ensuring a university education with important current and subsequent benefits in individual development and personal comfort.

The systemic modeling proposes two versions of spatial organization with 8-20 series/groups that may change depending on the number of participating teams.

Moreover, the capitalization on sports level of the dynamic and static resource of the universities multiplies their professional valences by: Promoting the dual concept of education and sports; Reducing school dropout and increasing the schooling period in the absence of a professional sports career perspective for young people/juniors who practice performance sports; Increasing the degree of insertion on the labor market through the access of young people/juniors to a higher level professional qualification; Through the opportunity offered by a university club, young people/juniors have the chance to continue the sport they loved from childhood; Intellectual stimulation contributes to building the winning mentality in sports and in life, to personal development based on a balance gained from a dual experience generated by passion for sports and academic education.

Finally, this study supports the dual career concept promoted by International University Sports Federation (IUSF/FISU) in relation with national sport university federations and universities "As the bridge where university meets sport, ...in a unique position to shape young lives and impact their futures".¹⁴

The research article was possible by equal scientific involvement of the authors.

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