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Neutrosophic Study on the Levels of Physical Activity in Undergraduate Medical Students

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Abstract. In this study, an assessment is made of the levels of physical activity of a group of university medical students. This is based on the benefits of physical activity for human health. Considering the above-mentioned arguments, the objective of the research was to assess the levels of physical activity of undergraduate medical students using neutrosophic tools. During the study, theoretical, empirical, and mathematical-statistical methods and techniques were presented. After applying the techniques and instruments, it was possible to identify the different levels of physical activity in the sample studied. These results allowed to open future research lines that imbricate Neutrosophy and sciences applied to physical activity.

Keywords: neutrosophic statistical analysis, neutrosophic graph, physical activity, health, university students.

1 Introduction

The practice of physical activity on a regular basis and healthy body weight are relevant actions to prevent the appearance of antisocial and harmful behaviors, in addition to social exclusion, associated with poor physical and mental health and a sedentary lifestyle [1].

From the holistic point of view of the concept of health, promoting a physically active lifestyle improves the quality of life of people from childhood. More active students interact better with their parents, show higher academic performance, have fewer socio-affective disorders, and even have healthier eating habits [2].

The beneficial effects of performing physical activity in daily life are undeniable, specially if habits are established from the beginning of the life cycle; therefore, the need to promote patterns of physical activity in all age groups is highlighted.

Physical activity is any movement that the human body performs and requires energy expenditure. That is why one of the important postulates in raising the quality of life of university students.

According to authors such as Airasca, physical activity and its link with health play a fundamental leading role, oriented to well-being, preventive and rehabilitative. In the present work, the first two are taken into consideration [3].

An important component of physical activity is health promotion and encouragement of physical activity in health services, school and community contexts, and comprehensive care institutions, among others. Well, this is aimed at preventing the appearance of diseases, generally of a non-communicable type [4], [17], [20].

The literature suggests that disjointed actions are developed in the promotion of physical activity in the university context: these efforts do not have the expected impact. Therefore, studies are required from other perspectives such as Neutrosophy.

Based on the arguments raised above, the following research objective is formulated: assess the levels of physical activity of undergraduate medical students from neutrosophic tools.

2 Methodology

2.1 Study subjects

For this investigation, the bases of Neutrosophy were taken into account on the samples systematized by several authors such as [5], [7], [17]. Those who state that there are different formulas for their selection. The ones

developed in this research are shown below.

p = approximate proportion of the phenomenon under study in the reference population

q = proportion of the reference population that does not present the phenomenon under study ($1 - p$)

The desired confidence level (Z). Indicates the degree of confidence that the true value of the parameter in the population is found in the calculated sample.

The absolute precision (d). It is the desired width of the confidence interval on either side of the true value of the difference between the two proportions (in percentage points).

N is the population size

For the present study, it proceeds as follows:

In this case, a confidence level between 90 and 95% is desired, $z = [1.644, 1.97]$

$d = [0.05, 0.0]$ and $p = [0.4, 0.43]$, $N = 40$.

The result that is called the neutrosophic sample $n = [10.3, 30.8]$ indicates that the sample must be in values between 11 and 33 medical school students.

According to this, a sample of 12 students from the Autonomous Regional University of the Andes, in Ecuador, is selected. This was done randomly, of them 8 are female, and 4 are male. With an average age of 28.5 years. All with medical experience.

All students signed the informed consent in accordance with the Declaration of Helsinki. Where they were given a detailed analysis of the research, its objectives, and the need to deepen this topic.

2.2 Instruments used

During the investigation, theoretical methods and techniques were applied, such as synthetic analytical and inductive-deductive, both of which were important for working with theoretical references. Within the empirical methods, the survey and the measurement were used, the first was used to obtain the data, and the second for the analysis of the results that, together with the mathematical statistics, would contribute to illustrating them. Calculations of measures of central neutrosophic tendencies were also performed. Particularly the average, to know how it is revealed by each of the selected levels. [22]

2.3 Neutrosophic method

For the development of the research, the following neutrosophic model is followed. As represented in Figure 1.

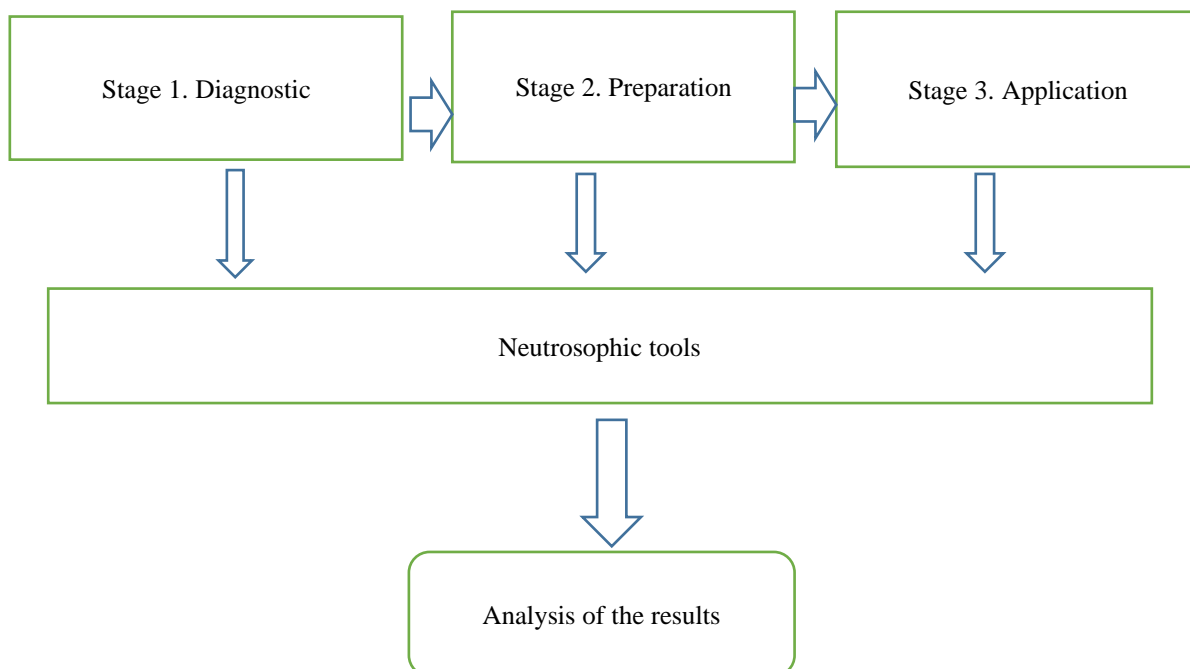


Figure 1: Neutrosophic model for the instrumentation of the research

2.4 Procedure used

For the assessment of physical activity levels, the Minnesota Physical Activity survey was used. Which consists of relating the main activities carried out by university students in the last week.

Which had a modification in correspondence with the characteristics and culture of the Republic of Ecuador. Subsequently, the energy expenditure calculations are made according to physical activity as described by the researcher Roig [8], [13], [16], [21] and then they are classified in the levels proposed by this same author. Which is presented in Table 1.

Levels	Energy expenditure
Light:	0.031 kcl
Active:	0.049 kcl
Very active:	0.096 kcl

Table 1: Levels of energy expenditure by physical activity. Prepared from data from F Grande Covián. Source: [8].

3 Results

The results are presented in correspondence to the neutrosophic model that appears in Figure 1 of the present investigation. It begins with a diagnosis of students' knowledge of the definition and classification of physical activity, for which a survey with two questions is applied. The results of which are presented below.

Stage 1 of the neutrosophic model

Questions	Yes		No	
	Quantity	Percentage	Quantity	Percentage
Know the definition of physical activity	4	33.4	8	66.6
They know what the main manifestations of physical activity are	3	12	9	75

Table 2: Results of the diagnostic survey on knowledge of the physical activity.

When assessing the results of the survey on the knowledge of medical students about physical activity, as shown in Table 2. Their knowledge is low. These results are supported by the answers to the two questions of the survey. Which are discussed below.

When evaluating the results of question 1, it can be stated that only 4 students for 33.4% expressed knowledge about the definitions of physical activity.

While the majority of these 8 for 66.6% reported not knowing definitions. Which denotes little knowledge of the students about this question.

Similar results were obtained in question 2, where 3 for 12% reported not knowing the main manifestations of physical activity.

On the other hand, most of the students reported not knowing them, this was reflected in 9 for 75%. Like the previous one, the majority of students are unaware of the main manifestations of physical activity, which limits the application of the subsequent Minnesota survey.

That is why the model has conceived a stage of preparation that will be described below. [18], [19], [23], [24], [25]

Stage 2 of the neutrosophic model

Once the results of the initial diagnosis were assessed, four workshops were held to prepare the students before applying the Minnesota survey.

The contents refer to the definitions of physical activity, main manifestations, types of physical activity, and the relationship between energy expenditure and physical activity. Once the knowledge has been verified and only when 100% of the sample masters the content, the Minnesota physical activity survey is applied.

Stage 3 of the neutrosophic model

Levels	Quantity	Percentage
Light	7	58.3
Active	3	25
Very active	2	16.7

Table 3: Minnesota Physical Activity Survey Results

After applying the survey, Table 3 is constructed in Minnesota to find out the levels of university students. Where its results show that the majority of students are at the light level, this is reflected in 7 for 58.3%. This places these students at risk factors for suffering from any of the non-communicable diseases or others that cause physical inactivity.

On the other hand, only 3 students for 25% are located according to their energy expenditure as active. Which favors that they are in the permissible ranges of levels of physical activity. Although they should perform more physical activity to continue improving their quality of life. On the other hand, only 2 students for 16.2% are classified as very active, a reason that places them in better conditions in the prevention of the risk factors of some diseases

Tools of neutrosophic statistics

Neutrosophic Statistics is the analysis of neutrosophic events and deals with neutrosophic numbers, neutrosophic probability distribution, neutrosophic estimation, and neutrosophic regression.

It refers to a set of data, which is formed totally or partially by data with some degree of indeterminacy and to the methods to analyze them.

Based on the above criteria, the neutrosophic mean of the three levels of physical activity is calculated, taking into account the indeterminacy of some of the students' daily activities [9], [10], [14], [17].

In this case, to calculate the mean of the recorded data, let us assume that the following values are observed for the 3 levels of physical activity.

Quantities containing an uncertainty component are represented as classical neutrosophic numbers, of the form:

$$N = a + Bi$$

Control	Number of students
1	7+4I
3	3+2I
4	2+1I

Table 4: Ranking of the data with indeterminacy

To calculate the mean of these values, the same equation is applied as in classical statistics, taking into account the peculiarities of operations with neutrosophic numbers [11], [15].

$$\bar{x}_N = \frac{(7 + 4I) + (3 + 2I) + (2 + 1I)}{3} = \frac{7 + 3 + 2}{3} + \frac{4 + 2 + 1}{3} \cdot I$$

$$\bar{x}_N = 4 + 2,3I = 6,3$$

Next, a neutrosophic graph [12] is shown, illustrating the relationship between determination and indeterminacy of weekly physical activity carried out by university students. This contributes to giving robustness to the results obtained.

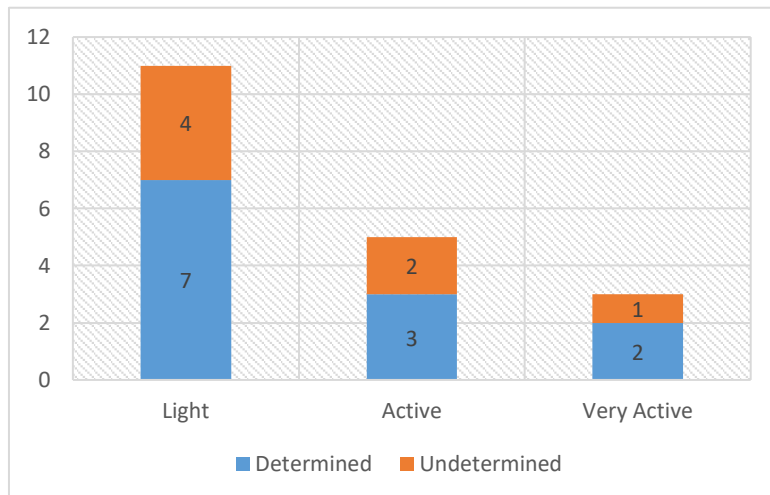


Figure 2: Graphic representation of the relationship between determination and indeterminacy

Conclusion

The assessment of the theoretical and methodological references on the use of neutrosophic techniques in the study of physical activity levels in university students shows the need to deepen this subject investigated from a neutrosophic approach.

The interpretation of the results, through a descriptive neutrosophic study, allowed to reveal the level of internal validity of the results presented in the selected sample.

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