

## Effects of the physical activity and sports program on medical students

### Efectos del programa de actividad física y deportes en estudiantes de medicina

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#### Abstract

The stage of life in the university is where healthy and harmful habits are structured in university students; the practice of physical activity and sports is essential in the body. The objective was to determine the effects of the physical activity and sports program in medical students of the National University of the Altiplano. Quantitative research method, applied type, with pre-experimental design, the population consisted of a total of 45 students, with a non-probabilistic sample of (18 women with age  $20.40 \pm$  (SD) 1.34 and 27 men with  $21.89 \pm$  (SD) 2.62). The instruments used were the questionnaires of physical activity and predisposition to sports workshops, anthropometric measurements (height and weight) and physical condition tests were applied. Results of women before BMI  $23.39 \pm 1.67$ , after  $23.15 \pm 1.47$ , in the flexibility test before  $22.39 \pm 8.14$  vs  $23.05 \pm 7.95$   $p < 0.002$ ; the male BMI before  $23.79 \pm 3.27$ , after  $23.50 \pm 3.02$ , in the flexibility test  $18.85 \pm 7.36$  vs  $19.07 \pm 7.10$   $p < 0.031$ , the level of physical activity was increased from low to moderate. It is concluded that there are significant effects of the physical activity and sports program in the decrease in BMI and improvements in physical condition.

**Keywords:** Physical activity, sports and healthy life.

#### Resumen

La etapa de vida en la universidad es donde se estructuran hábitos saludables y nocivos en los estudiantes universitarios; la práctica de actividad física y deportes es primordial en el organismo. Se planteó como objetivo determinar los efectos del programa de actividad física y deportes en estudiantes de medicina de la Universidad Nacional del Altiplano. Método de investigación cuantitativo, tipo aplicada, con diseño pre experimental la población estuvo conformado por el total de 45 estudiantes, con muestra no probabilística de (18 mujeres con edad  $20.40 \pm$  (DS) 1.34 y 27 varones con  $21.89 \pm$  (DS) 2.62). Los instrumentos utilizados fueron los cuestionarios de actividad física y predisposición a los talleres de deportes, se aplicó las medidas antropométricas (estatura y peso) y los test de condición física. Resultados mujeres antes el IMC  $23.39 \pm 1.67$ , después  $23.15 \pm 1.47$ , en la prueba de flexibilidad antes  $22.39 \pm 8.14$  vs  $23.05 \pm 7.95$   $p < 0,002$ ; el IMC varones antes  $23.79 \pm 3.27$ , después  $23.50 \pm 3.02$ , en la prueba de flexibilidad  $18.85 \pm 7.36$  vs  $19.07 \pm 7.10$   $p < 0,031$ , se incrementó el nivel de actividad física de bajo a moderado. Se concluye que existe efectos significativos del programa de actividad física y deportes en la disminución del IMC y mejoras de la condición física.

**Palabras clave:** Actividad física, deportes y vida saludable.

## Introduction

The current society in which we live of accelerated technological and scientific advancement brings with it that young university students are more in front of the screen of a computer, tablet and cell phone, developing sedentary life habits and consequently predisposition towards chronic non-communicable diseases (CNCD). The University does not play the role that it could play in terms of promoting healthy lifestyles and abandoning styles that are harmful to health (Castro *et al.*, 2014).

The University can and should play a substantial role in promoting healthy lifestyles, since youth are the majority group. University students are in a stage of life of great importance for health in which lifestyles (healthy or unhealthy) develop and are consolidated, decision-making and independence grow. In addition, the future professionals who will configure the services of the community are trained there. The promotion of health in the academy will allow them to be trained in order to act as promoters of healthy behaviors in their families, in their future work environments and in society in general (Red Española de Universidades Saludables, 2017).

Likewise, students present high levels of sedentary lifestyle, low physical activity, a high frequency of physical inactivity and harmful lifestyles in the university population significantly associated with obesity and the female gender, which could affect their weight and body composition and in knowing and accepting your own body. Data that become an elementary baseline for the development of specific training and physical activity programs for the university population. This is why it is necessary to implement new strategies that encourage people to develop healthier lifestyles (García *et al.*, 2019; Moreno 2018; Telleria *et al.*, 2015).

According to Zarceño *et al.*, (2015) points out that three out of four university students surveyed consider that to lead a healthy lifestyle it is necessary to practice physical activity, however, almost half of university students admit not doing any type of physical activity or sport in their free time; Universities must take a responsible part in actions to promote the implementation of healthy lifestyles, in terms of regular physical activity, and be included in health promotion plans.

On the other hand, sociodemographic factors, the university environment and motivational factors help to explain the intention and practice of physical activity (PA) in free time and their differences will be decisive for educating healthy behaviors (Gomez *et al.*, 2020). University students, as well as the population, maintain unhealthy physical activity practices and eating patterns (Chales y Escobar, 2019). Along the same lines, university students present risk factors associated with low levels of PA and excess weight, factors that are mostly modifiable, except for gender and age (Concha, *et al.*, 2018).

Some studies on the lifestyles of university students have shown the existence of unhealthy lifestyles, also suggesting that, during the university stage, students abandon healthy habits and acquire other harmful ones. There is no doubt that certain types of behaviors such as smoking, an unhealthy diet, a sedentary life or excessive alcohol consumption could contribute by themselves to increase morbidity and even mortality (Cecilia *et al.*, 2018). In a recent review on the lifestyles of young university students, it is shown that, despite being aware that a good diet and physical activity (PA) have beneficial effects on health, they do not have habits of healthy lives (Sánchez y De Luna, 2015).

Healthy lifestyles in university students are multifactorial, such as abandonment of the family home, interaction with people from different places of origin, change in nutritional habits, academic activities, and sleep and rest patterns, which interfere in the attempt to maintain a healthy life (Suescún *et al.*, 2017). The benefits of physical activity and the prescription of individualized exercise always considerably exceed the possible risks to which they are exposed by their practice (González y Rivas, 2018).

The evidence for the role of physical activity and exercise in the prevention of various diseases, including cardiovascular diseases, appears to be as strong for women as for men. When prescribing exercise, it is important to take into account characteristics of women, such as body composition and endocrinological traits, since they represent differences in physiological responses to acute exercise and prolonged training (González y Rivas, 2018; Warburton y Bredin, 2016).

The research reviewed supports an important relationship between dose response in terms of levels of physical activity and health benefits and risk reduction from inactivity; that is, higher volumes bring more benefit, but always ideally within a healthy lifestyle plan (Brown *et al.*, 2014). Similarly, participation in a physical training program has positive effects on autonomic cardiac balance in patients with Chronic Heart Failure (CHF).

Cardiac Rehabilitation (CR) programs offer interventions of physical exercise, psychology, education on healthy lifestyles in order to achieve and maintain a better state of health and reduce the risk of death by 20-25% (Carrillo, 2020). Physical activity and exercise at home, which have been used before with good results, even in patients with cardiovascular disease is essential to practice them, also practicing simple to complex movements according to the level of physical activity and conditioning during the stay at home is important because it contributes to improving physical condition (Hageman *et al.*, 2018; Hammami *et al.*, 2020; Pecanha *et al.*, 2020).

Cardiovascular diseases are the most prevalent in Western society. In the last decades, innumerable publications report on the therapeutic power of physical exercise (PE) in these pathologies. It is essential to reflect on the association between Cardiometabolic Risk Factors (CMRF) and Levels of Physical Activity (PAL), which was independent of sedentary lifestyle (Aramendi y Emparanza, 2015). It is extremely important to implement effective physical activity programs in universities, motivating students to increase Physical Activity Levels (PAL) to moderate and vigorous ranges, in order to reduce cardiovascular risk (Morales *et al.*, 2018).

In the same way, a current public health problem is sedentary lifestyle, it is considered sedentary from the point of view of time, those people who do not perform at least 150 minutes of moderate physical activity on five or more days of the week or those who do not perform three or more sessions of 20 minutes of vigorous physical activity a week, and from the point of view of energy expenditure, to those people who do not generate an energy expenditure of approximately 720 kcal per week (Pate *et al.*, 2008).

The practice of physical activity and sports in a systematic way develops healthy lifestyles in university students, quantifying these variables is essential for the prevention and promotion of healthy lifestyles and intervening in the prevalence of (CNCD). For this reason, the objective was to determine the effects of the physical activity and sports program in medical students of the National University of the Altiplano.

## Theoretical framework

### Physical activity

Physical activity and physical exercise are medical recommendations that have been implemented since ancient times by Hippocrates himself, so much so that in the first third of the 20th century the teaching of physical education in the USA was included in medical schools, by the Dr. McKenzie, which is lost with specialization (Licht, 1986). Likewise, the OMS, (2018) defines physical activity as any body movement produced by the skeletal muscles, with the consequent consumption of energy. This includes activities carried out while working, playing and traveling, household chores and recreational activities.

Scientific literature has shown that the regular and systematic practice of physical activity offers great benefits for health, both at a physiological, mental and social level, as well as reducing the risk of suffering premature death from any cause in young and middle-aged people. (Nocon *et al.*, 2008; Práxedes, Sevil, Moreno, Del Villar y García, 2016). Evidence supporting the importance of an active lifestyle has grown exponentially and physical activity and regular exercise are considered effective primary and secondary preventive measures for the prevention and promotion of health, including cardiovascular disease and premature mortality (Warburton, 2016).

Physical exercise decreases appetite, hunger and energy intake, in addition, exercise slows down ghrelin levels and increases leptin concentrations. Likewise, it is shown how physical exercise alters the activity of certain regions of the brain after the visualization of certain foods, thus reducing appetite or food intake (Gómez *et al.*, 2017).

The OMS, (2018) points out the importance of carrying out moderate and intense physical activity and that adults from 18 to 64 years old should carry out the following physical activities of:

- Practice at least 150 minutes a week of moderate physical activity, or at least 75 minutes a week of vigorous physical activity, or an equivalent combination of moderate and vigorous activity.
- For the greatest health benefits, adults should achieve 300 minutes of moderate physical activity per week, or its equivalent.
- It is advisable to carry out muscle strengthening activities 2 or more days a week and in such a way that large muscle groups are exercised.

In addition, sport is a type of physical exercise that is practiced according to rules or regulations, which is structured in training that seeks to improve physical form to carry out competitions with opponents or with oneself, and competition, which is the main characteristic that defines the practice of a sport (Ortega, y Amat, 1997). It is divided into: individual, which usually correspond to comparisons of physical performance, such as rowing, athletics, cycling, etc., and team, such as football, basketball, volleyball, etc., which correspond to games, which also include individual racket sports.

Returning to the topic at hand, the BMI is the test to determine if a person is overweight or obese from taking basic bioanthropometric measurements of body weight and height squared. The values presented in Table 1 are set by the (OMS, 2018).

**Table 1.**  
*Limit values of BMI*

Classification	BMI(Kg/m <sup>2</sup> )	Risk associated with health
Normo weight	18,5 - 24,9	Average
Excess weight	≥25	
Overweight or pre-obese	25 – 29,9	Increased
Grade I obesity or moderate	30 – 34,9	Moderate increase
Grade II obesity or severe	35 – 39,9	Severe Increase
Grade III obesity or morbid	≥40	Very severe increase

## Methodology

The quantitative approach was used with a type of applied research with a pre-experimental pre-test and post-test design. The population was made up of 45 students, the type of non-probabilistic sample was used working with (18 women aged  $20.40 \pm$  (SD) 1.34 and 27 men with  $21.89 \pm$  (SD) 2.62) from the IV cycle of students of the Faculty of Medicine of the National University of the Altiplano.

The applied technique was observation and the instruments applied were the international physical activity questionnaire for use with young people and middle-aged adults (15-69 years) IPAQ (Di, Di, y González, 2017), the questionnaire of predisposition to sports and taking anthropometric measurements of height and weight (Marfell, Olds, Stewart, y Carter, 2008).

This study has the informed consent of all the participants likewise, the procedure for taking bioanthropometric measurements (height and weight) was explained to them, the following measurements were made:

**Height:** the perpendicular distance between the transverse plane of the vertex and the lower edges of the feet was evaluated. The stadiometer or height rod (0.5 cm precision) with ranges from 60 to 213 cm was used.

**Procedure:** the height in maximum extension was recorded, requiring the student to stand with the heels together, the buttocks and the upper part of the back supported by the stadiometer that is located on the wall. When the head is located in the Frankfort plane, it is achieved when the orbital (inferior margin of the ocular orbit) is horizontally aligned with the tragion (superior cartilaginous protrusion of the ear) (Marfell, *et al.*, 2008).

**Body weight:** mass is calculated by measuring weight, that is, the force that matter exerts in a standard gravity field. The digital scale with a capacity of 350 lb/160 kg was used.

**Method:** the evaluation record was evaluated with the body with minimal clothing (polo shirt and shorts), the subject is standing on the center of the scale without being supported and with the weight evenly distributed on both feet.

For the physical condition variables, the tests of:

Sit-ups, the maximum number of sit-ups in 30 seconds was measured in a lying position with knees bent 90 degrees, feet 30 cm apart from the buttocks, arms extended forward with palms resting on the thighs.

The evaluator kneels behind the evaluated person, clasps his hands and places them under the examinee's head 5cm from the subject. The movement consists of slowly getting up, sliding your hands over your thighs until the tips of your fingers touch the kneecaps and you return to the previous position until you make contact with the evaluator's hands. The examinee's feet should not be held (Alba, 2005).

Arm power, the maximum number of repetitions of tractions on a fixed bar was evaluated, with a time limit of 30 seconds, the taking of the bar from the hands in supine is considered for the measurement, and that the chin passes the bar.

Flexibility, this test aims to evaluate the flexibility of the trunk, the drawer with the brand rod is required. The examinee sits on the floor with the back and head in contact with a wall, the legs fully extended and the soles of the feet in contact with the test box. The hands are placed one on top of the other stretching the arms forward, but keeping the head and back in contact with the wall. The distance from the tip of the fingers to the edge of the drawer is measured, which is considered the zero value. A forward bend is performed slowly, trying to extend as much as possible. This position is held for 2 seconds. The movement is repeated 3 times and the best result is chosen. If it does not touch the edge of the drawer, negative values are given.

Long jump test from its place, the rapid strength of the lower limbs is evaluated. The examinee stands frontally with semi-flexion of the knees and the separation of the legs at the level of the shoulders, then balances the arms backwards and jumps with both feet together. The jump is repeated 2 times and the best result is chosen.

For the sports variable (basketball, soccer), the basic fundamentals were developed: passing, receiving, driving and finishing. In volleyball; the low reception, volley, and auction and the practice of sports was prioritized among the students (men

and women) for the development of enjoyment and enjoyment of the practice of sports. These activities were carried out after the work of physical capacities. All these tests were applied to the experimental group in the pre-test and post-test respectively.

### Process

The intervention was developed for 3 days a week in the months of March to July 2018. The exercise consisted of the development of 3 sessions on alternate days (Monday 120 minutes, Wednesday 60 minutes and Friday 120 minutes) the effective work was of 60 minutes for Monday and Friday (developing first the general and specific warm-up activities and the strength work was individualized based on the load: type of exercise, volume, intensity and duration) (Dietrich, Klaus y Klaus, 2001). Then, stretching, relaxation and breathing exercises were carried out and it was accompanied with healthy lifestyles in the intake of water and fruits and later it was completed with free sports workshops promoting the training and spontaneous participation of medical students. Likewise, the progression of the exercise was individualized and the increments of 5 minutes per day were made until reaching 60 minutes in the muscular resistance program, free weights were used in one repetition with an increase or decrease of the load from 2.5 to 5 pounds, until determining the maximum weight to lift. A maximum repetition was considered valid with a complete extension of the muscle group used, without muscle substitutions.

On the other hand, the adaptation was made for the development of the physical condition of the students, where strength, speed and endurance were developed, the load with its components was prioritized:

Volume of the load in the training of strength, speed and resistance developing the following activities:

- The weight (kg) displaced in the (session) with jumping exercises (jumping jacks).
- Number (n) of repetitions of certain exercises (jumps on the same place, long jump with one foot, alternating, two feet and ball throws at medium height, elevated height).
- The length of the routes meters (m), series and repetitions carried out in the session with short-speed exercises, head-on, diagonally right and left.

- The length of the routes (m, km), their series and repetitions carried out in the session with the performance of exercises began with continuous 6-minute walks and then with 12-minute races, doing it according to their tolerance and metabolism of their body, it should be noted the importance of it was established that there would be no winner, but rather determined the formation of the rhythm of his own career.

Intensity of the load in the training of strength, speed and resistance was increased individually, taking into account their age, sex, morphological type and the following activities were developed:

- Walking, slow and fast jogging and speed exercises.
- Carrying out exercises of maximum concentric strength.
- Performing isometric strength exercises.
- Performing maximum speed exercises in an exercise form of 30, 50 meters.
- Performing exercises (maximum, sub-maximum) of upper and lower limbs.
- Taking the heart rate before, during and after aerobic exercises.

Duration of the load in the training of strength, speed and resistance, the following activities were developed:

- Performing strength exercises at the level of the upper and lower limbs.
- Performing abdominal exercises, flexibility and stretching.
- Performing exercises of strength, speed, flexibility and coordination by workstations of 30 seconds for 7 seconds of recovery.

Density of the load in the training of strength, speed and endurance, activities of time, rest were developed according to the physiological individuality of university students.

For the statistical analysis, the descriptive and inferential analysis processed with the program SPSS Statistics version 25 was used, determining minimum, maximum, average standard deviation and the test statistic with a 95% confidence interval.

## Results and discussion

**Table 2.**

*Anthropometric characteristics and physical condition in female medical students of the National University of the Altiplano.*

	Pretest	Minimum	Maximum	Posttest	Minimum	Maximum	p-value
Age years	20.44±1.42	19	23	20.44±1.42	19	23	
Body weight	56.07±5.65	45	66	55.66±5.16	45	63.6	0,076
Height (mt)	155.89±2.69	147	158	155.89±2.69	147	158	
BMI (Kg/mt <sup>2</sup> )	23.39±1.67	20.82	26.43	23.15±1.47	20.82	25.47	0,076
Sit-ups	14.22±3.70	10	25	15.05±4.05	11	26	< 0,003
Arm power	17.78±7.36	8	32	18.16±7.66	9	34	< 0,015
Flexibility (cm)	22.39±8.14	4	36	23.05±7.95	7	36	< 0,002
Long jump test (cm)	125±0.12	110	145	129±0.11	115	149	< 0,000
Level of physical activity	Low			Moderate			< 0,000
Predisposition to sports workshops	Low			High			< 0,000

Anthropometric characteristics and physical condition in female medical students of the National University of the Altiplano.

In the pre-test, women present a body weight of 56.07±5.65, compared to the start test 55.66±5.16, significantly decreasing the BMI before 23.39±1.67, after 23.15±1.47, in the sit-ups tests

before 14.22 ± 3.70, after 15.05±4.05, arm power before 17.78±7.36, after 18.16±7.66, flexibility before 22.39±8.14, after 23.05±7.95, in the long jump test before 125±0.12 and after 129±0.11, and the level of physical activity increased from low to moderate, and predisposition to workshops increased from low to high.

The BMI in the group of women studied was ( $23.15 \pm 1.47$ ) similar to that found by (Perez *et al.*, 2016; Telleria *et al.*, 2015) in both cases they are located on the normal weight scale, the university study period should be used by students to promote the practice of physical-sporting exercise; likewise, low to moderate levels of physical activity present lower levels of anxiety and depression than sedentary students (Olmedilla *et al.*, 2010). This suggests the need to promote actions aimed at counteracting modifiable risk factors and promoting healthy lifestyles in higher education (Concha, *et al.*, 2018).

In the sit-ups test there were ( $15.05 \pm 4.05$ ) lower results, compared to Valdes *et al.*, (2015) ( $25.0 \pm 1.0$ ); in the flexibility test there is

( $23.05 \pm 7.95$ ) compared to (Bonet *et al.*, 2016) in their study with non-active women it is ( $35.21 \pm 11.18$ ) in addition, they are below the acceptable range compared to (Perez *et al.*, 2016) where 16 students are located on the excellent scale (24-55) differences that requires intervention with healthy lifestyles; also a high level of sedentary lifestyle among young university students. The negative perception of the obese image continues, especially in women (Trejo *et al.*, 2016).

The university stage is a sensitive time regarding the practice of physical activity (PA), especially in women they identified barriers to practicing PA, as lack of time was shown as one of the biggest obstacles to doing PA. Women and people who did not comply with PA recommendations presented a

**Table 3.**

*Anthropometric characteristics and physical condition in male medical students of the National University of the Altiplano.*

	Pretest	Minimum	Maximum	Posttest	Minimum	Maximum	p-value
Age years	21.89±2.66	18	28	21.89±2.66	18	28	
Body weight	66.99±9.11	52.1	90	66.18±8.25	52.1	87	< 0,001
Height (mt)	167.91±4.50	169	172	167.91±4.50	169	172	
BMI (Kg/mt <sup>2</sup> )	23.79±3.27	18.24	30.42	23.50±3.02	18.24	29.40	< 0,001
Sit-ups	17.81±2.84	13	25	18.22±2.99	14	26	< 0,000
Arm power	23.74±9.35	10	43	24.18±9.11	12	43	< 0,003
Flexibility (cm)	18.85±7.36	4	32	19.07±7.10	6	32	< 0,031
Long jump test (cm)	159±0.13	135	178	163±0.11	137	180	< 0,000
Level of physical activity	Low			Moderate			< 0,000
Predisposition to sports workshops	Low			High			< 0,000

high prevalence of barriers to PA practice. (Sevil, Práxedes, Zaragoza, Álvarez y García 2017).

In the pretest, men present a body weight of  $66.99 \pm 9.11$ , compared to the exit test  $66.18 \pm 8.25$ , significantly decreasing the BMI before  $23.73 \pm 3.27$ , after  $23.50 \pm 3.02$ , in the sit-up tests before  $17.81 \pm 2.84$ , after  $18.22 \pm 2.99$ , arm power before  $23.74 \pm 9.35$ , after  $24.18 \pm 9.11$ , flexibility before  $18.85 \pm 7.36$ , after  $19.07 \pm 7.10$ , long jump test before  $159 \pm 0.13$  and after  $163 \pm 0.11$  and the level of physical activity increased from low to moderate and the predisposition to sports workshops increased from low to high.

The BMI in the studied sample showed a normal weight for their height, coinciding with (Molano, Vélez y Rojas 2019) 76.9% of the population have a normal weight for their height ( $n = 269$ ), at the same time, men show healthier practices than women and in the practice of physical activity in the study it is located in moderate compared to

unhealthy practices of (Molano *et al.*, 2019).

In the sit-ups test there are ( $18.22 \pm 2.99$ ) lower data compared to Valdes *et al.*, (2015) ( $24.9 \pm 0.2$ ); In the long jump test, ( $163 \pm 0.11$ ) was obtained compared to ( $185.3 \pm 34.5$ ), a non-optimal physical condition in which university students are. The levels of physical activity increased from low to moderate with a  $p < 0.000$  allow corroboration with what he maintains (Caro *et al.*, 2013) where he indicates that carrying out an active life with regular and moderate physical exercise leads to an increase in insulin sensitivity, a better lipid profile and a decrease in the components of Metabolic Syndrome (MS) without necessarily modifying body weight. Likewise (Couto *et al.*, 2018) refer that the practice of physical activity (PA) is essential for health and quality of life (QoL).

The importance of developing prevention programs at the University and intervention strategies and policies that allow improving the management of

leisure time and temporary availability and the interest and motivation towards physical activity in university students to establish more lifestyles is highlighted. active and autonomous at this stage (Angelucci, Cañoto y Hernández 2017; Castañeda *et al.*, 2018, Sevil *et al.*, 2017).

Unhealthy habits should be addressed through comprehensive educational and policy measures that address the complex issue of promoting physical activity, healthy nutrition, active lifestyle, and proper body weight management among college students (Lotrean, Stan, Lencu y Laza, 2018). Where students who perform more physical activity during free time are less likely to have low consumption of fruits and vegetables. It is important to implement strategies that promote the acquisition of healthy lifestyle habits in the university population in order to reduce the future risk of suffering from chronic non-communicable diseases (Rangel, Murillo y Gamboa 2018).

## Conclusions

There are significant effects of the physical activity and sports program in medical students of the National University of the Altiplano since they significantly decreased body weight by an average of 0.61 grams, and BMI by 0.23 points. The sit-ups tests, arm power, flexibility and long jump, increased in the posttest, in addition the level of physical activity increased from low to moderate level and the predisposition to sports workshops increased from low to high, habits of systematic practice of physical activity and healthy sports in students. The University is the space where university students develop, form and acquire healthy or harmful habits for their health; it is necessary to implement physical activity and sports programs in a planned and sustainable manner within the University.

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## Conflict of interests

The author declares to have not any conflict of interest.

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