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Circadian cycle and impact on metabolic health of adults

Abstract

Currently overweight and obesity are an epidemic and represent a global public health problem. They are related to a greater probability of developing chronic diseases, which are increasing and represent a significant burden on the health system. A diet synchronized with the circadian cycle and based on natural foods with a low glycemic index and healthy fats has gained considerable scientific and popular impact; and they are effective practices for the treatment of excess weight and its comorbidities. The objective was to analyze the impact of CC (Circadian Cycle) synchronization on the metabolic health (biochemical and anthropometric parameters) of overweight and obese people. A correlational, longitudinal study was carried out. 80 individuals of both sexes between 18 and 59 participated for ten months. The sample was made up of 32.5% men and 67.5% women. 96% of the individuals registered weight loss. Regarding the percentage of body fat, 55% started with a "very high" diagnosis, and at the end of the period it was reduced to 30%. 75% began with a waist circumference diagnosis of "very high risk" and this was modified to 55%. Regarding total cholesterol, 40% decreased its value compared to the initial one; Regarding LDL, 85% decreased the value to normal parameters; In relation to triglycerides, 95% positively modified their values. Synchronized feeding with CC weight loss, a decrease in abdominal fat mass, a decrease in WC, and positively influences the biochemical parameters of the overweight and obese people analyzed, to a greater extent in males and females in young adults ($p<0.05$).

Keywords: circadian cycle (CC), low glycemic index diet, metabolic health

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Introduction

Currently, one of the main epidemiological problems worldwide is obesity. The World Health Organization defines obesity as "the abnormal or excessive accumulation of fat that may be harmful to health". The development of obesity is related to excessive nutrient consumption, poor diet, low physical activity, and chronic insulin resistance. However, obesity is also associated with alterations in circadian rhythms, such as those that regulate sleep and food intake. The term circadian derives from the Latin, circa (approximate) and dies (day), which denotes approximately, "one day". Circadian rhythms are the product of biochemical and behavioral oscillations, which create a 24-hour cycle of physical and mental changes, that is, periodic patterns that repeat during a day, which are mainly coordinated with the external cycles of light and dark.

A regular meal schedule helps maintain the internal temporal order of the circadian system. Various observational studies have confirmed that the ability to regulate blood sugar varies throughout the day, and becomes much slower at night. This is why people who work night shifts are more likely to gain weight or have diabetes. Similarly, various animal experiments carried out by the chronobiology study group led by Garaulet showed that reversing the feeding/fasting cycle, without changes in total caloric intake, caused a dramatic increase in weight gain using only one high-fat diet. On the other hand, studies in humans carried out by Jakubowicz under controlled laboratory conditions and including an isocaloric diet showed that eating during the night and fasting during the day was accompanied by an alteration in glucose tolerance and a decrease in plasma leptin concentrations. Likewise, it has been proven how subtle changes in meal timing that are reflected in the distribution of caloric intake during a normal period of wakefulness influence the success of weight loss therapies. For example, a 12-week experimental study showed that subjects assigned a high breakfast calorie intake of approximately 700 kilocalories (Kcal) lost more weight than those assigned a high calorie consumption during dinner (also 700 kcal)

Circadian rhythms are defined in humans through chronotype. This term is defined as the characteristics that an individual has in relation to circadian rhythms, which are marked by sleep schedules and habits, physical activity, energy, etc. The chronotype as such reflects differences in the body's preference for times to carry out the day's activities. In humans, chronotype is classified into three broad categories: morning chronotype, evening chronotype, and neutral chronotype. Firstly, the morning chronotype, also known as lark or type M (morning type), is reflected in people who have greater activity, both energetic and mental, early in the day.[1,2]

Secondly, there are the evening ones, the names of chronotype owl or type E (evening type) also define them. They are people who have their peak of mental and energetic activity in the afternoon. The last chronotype type is neutral, also known as intermediate. They represent 60% of the world's population and are characterized by not having problems adapting to schedules. From these three types of chronotypes, there are hybrids between them, with different names and characteristics that derive from the main ones. As a result of the study of the human chronotype, in the results obtained, differences have been observed in terms of characteristics (such as habits and personality) and other factors such as the eating pattern or the quality of sleep of people depending on their chronotype.

Carlota Anaya Pérez maintains that at the beginning, the literature on weight loss and chronotype was practically non-existent, since chronotype was not taken into account as a relevant factor for weight loss and body composition. Currently, it is believed that due to the

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imposition of both social and work schedules, people with an E chronotype are more vulnerable to the development of NCDs such as obesity and T2DM, as well as poorer blood glucose control. One of the latest studies that have been carried out on food intake, chronotype and body composition concludes that people with a morning chronotype are more likely to gain weight if they eat most of their meals in the afternoon and those who are evening chronotypes if they eat most of their food in the morning.

Objective

General objective

Analyze the impact of circadian cycle synchronization on the metabolic health of adults in the city of San Luis.

Specific objectives

Identify changes in the body composition of adults who perform nocturnal digestive rest synchronized with the circadian cycle. To analyze the changes in the biochemical parameters of adults who perform nocturnal digestive rest synchronized with the circadian cycle

Materials and methods

Type of study: quantitative, descriptive, longitudinal retrospective. Population and sample: Population: adults of both sexes (>20 years) to whom a food protocol synchronized with the circadian cycle was implemented in the province of San Luis (Argentina) during the year 2023. Type of sampling: intentional non-probabilistic. Sample: was made up of patients who attend the nutrition clinic of a Private Medical Clinic in the province of San Luis, with a diagnosis of overweight, obesity or some chronic non- communicable disease who practice the food protocol of feeding synchronized with the circadian cycle (rest nocturnal digestive: intermittent fasting from 12 to 2 p.m.) who adopted a healthy diet based on natural foods with a low glycemic index indicated by a professional with a degree in Nutrition and who previously provided informed consent. 80 individuals of both sexes >20 years old participated for ten months. Variables: Sex; Age; Nighttime digestive rest practice. Impact on body composition and biochemical parameters of the implementation of nocturnal digestive rest.

Results and discussion

The sample was made up of 32.5% (n=26) men and 67.5% (n=54) women. 96% (n=77) of the individuals recorded weight loss. 80% (n=64) of the sample showed a decrease of more than 25% in weight compared to their initial weight, the remaining percentage (16%; n=13) decreased from 10 to 25%. Regarding the percentage of body fat, 55% (n=44) started with a diagnosis of "very high", and at the end of the analyzed period, this percentage was reduced to 30% (n=24). 75% (n=60) began with a "very high risk" abdominal waist circumference (WC) diagnosis; after treatment, this percentage changed to 55% (n=44).

According to the following studies:[2] Intermittent fasting can have an impact on weight, fat percentage and waist circumference in several ways:

Reducing caloric intake: By limiting the time window in which eating is allowed, total caloric intake is likely to be reduced. If you consume less energy than you burn, weight loss may occur.

Increased fat burning: During prolonged fasting, the body can deplete its glycogen stores (a form of energy storage), leading to increased burning of fat as a fuel source. This can contribute to weight loss and a reduction in waist circumference.

Hormone regulation: Intermittent fasting can affect hormones related to appetite and metabolism, such as insulin, ghrelin, and leptin. These hormonal alterations can influence weight control and the reduction of abdominal fat.

In relation to chronotype and percentage of body fat, it is observed that those women studied who have a percentage of body fat greater than 25% (categorized as obese) have significantly lower values in the chronotype scores ($p = 0.05$), which It is associated with a night-owl phenotype. In the sample studied, it is observed that people who have a BMI greater than 25 (considered overweight or obese) have lower chronotype scores (night owl chronotype) in relation to those who have a normal BMI, less than 25, where the chronotype scores chronotype are: 48.5 v/s 49.1. The above is observed only in women. However, this trend is not statistically significant ($p = 0.80$).

In the study by Palla et al., concluded that adolescents who tend to eat main meals earlier, but high energy intake at night, had higher BMI and WC compared to main subjects who ate meals a little later but without consuming caloric foods at night. The chronotype with a tendency to consume more calories at night could be an important determinant in food intake behavior.

Regarding total cholesterol, 40% of the sample (n=32) decreased its value compared to the initial value ($\bar{x}$: 280 to 187 ± 20 mg/dl), the remaining did not modify it; Regarding LDL, 85% (n=68) decreased the value to normal parameters ($\bar{x}$: 150 to 98 ± 15 mg/dl); and in relation to triglycerides, 95% (n= 76) positively modified their values ($\bar{x}$: 180 to 78 ± 10 mg/dl). Studies carried out by Varady, et al.,[3] with obese subjects show a reduction in total LDL levels in subjects who follow an intermittent fasting diet based on the circadian cycle, which represents a reduction in the risk of suffering from disease cardiovascular. There are many articles that defend that a low-carbohydrate diet synchronized with the circadian cycle and with chronotypes reduces triglycerides and, therefore, the risk of suffering from metabolic syndrome and cardiovascular disease. This is due to the decrease in plasma insulin levels, thus La Bounty and Tinsley discover that fasting periods between 18 and 24 hour are beneficial in increasing lipid metabolism, which promotes the use of fats as source of energy, which implies greater fat loss.[4–15]

Conclusion

Eating synchronized with the circadian cycle promotes weight loss, a decrease in abdominal fat mass, a decrease in WC, and positively influences the biochemical parameters of the overweight and obese people analyzed, to a greater extent in the male sex and in young adults ($p<0.05$). Given the high global and regional prevalence of chronic diseases and the growing beneficial, but at the same time questioned, scientific evidence of fasting periods synchronized with circadian rhythm; the need arises to investigate the practice and health effects of the aforementioned dietary protocol. This type of research interventions in health and nutrition are crucial to early identify prevalent health problems and propose preventive health strategies. At the same time, it allows us to generate scientific knowledge that can be communicated and shared, which results in academic enrichment for both the applicant and the healthcare areas.

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Conflicts of interest

I do not have any conflict of interest in this study.

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