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Sleep Quality: A Key Factor in the Physical and Mental Recovery of Medical Students

Calidad del Sueño: Factor Clave en la Recuperación Física y Mental de Estudiantes de Medicina

Javier Gonzalez-Argote[1] ✉

[1]Universidad Abierta Interamericana, Facultad de Medicina y Ciencias de la Salud, Carrera de Medicina. Ciudad Autónoma de Buenos Aires, Argentina.

ABSTRACT

Introduction: Sleep is considered a physiological process of vital importance for the overall health of human beings. Sleep quality is one of the most widespread and least understood clinical aspects, so it is necessary to know about its incidence and the factors that may be determining it.
Objective: To evaluate the sleep quality in third-year medical students from two health sciences faculties.
Methods: An observational, descriptive, cross-sectional study was conducted in 312 students from two health sciences faculties. The Pittsburgh Sleep Quality Index was used.
Results: 1,92 % described that their sleep quality is poor, and 17,31 % reported sleep efficiency below 85 %, a percentage that is considered the threshold for diagnosing insomnia. It was found that 60,33 % of the sample would be defined as poor sleepers *vs.* 39,66 % defined as good sleepers.
Conclusions: The study revealed that approximately 70 % of the subjects experience poor sleep quality, which is exacerbated by the consumption of alcohol, coffee and tobacco. This shows that, in addition to the various negative effects of excessive consumption of these substances, we must also consider a poor sleep quality.

Keywords: Subjective Sleep Quality; Pittsburgh Sleep Quality Index; Alcohol; Caffeine; Tobacco; Physical Recovery; Mental Recovery.

RESUMEN

Introducción: el sueño es considerado como proceso fisiológico de vital importancia para la salud integral de los seres humanos. La calidad del sueño implica uno de los aspectos clínicos más extendido y menos comprendidos, por lo que se hace necesario conocer respecto a la incidencia y los factores que la puedan estar determinando.
Objetivo: evaluar la calidad del sueño en estudiantes del tercer año de medicina de dos facultades de ciencias de la salud.
Métodos: se realizó un estudio observacional, descriptivo, de corte transversal en 312 estudiantes de dos facultades de ciencias de la salud. Se utilizó el índice de Calidad del Sueño de Pittsburg.
Resultados: el 1,92 % señaló que su calidad de sueño es mala y 17,31 % informó una 85 %. Se encontró que 60,33 % de la muestra sería definida como de malos dormidores frente a 39,66 % de buenos dormidores.
Conclusiones: el estudio reveló que aproximadamente el 70 % de los sujetos presenta una mala calidad de sueño, y que ésta se ve deteriorada por el consumo de alcohol, café y tabaco. Ello demuestra que, a los diversos efectos negativos del consumo excesivo de estas sustancias, debemos añadir una mala calidad del sueño.

Palabras clave: Calidad Subjetiva Del Sueño; Índice De Calidad Del Sueño De Pittsburg; Alcohol; Cafeína;

Tabaco; Recuperación Física; Recuperación Mental.

INTRODUCTION

Sleep, as opposed to wakefulness, is considered a state of unconsciousness from which an individual can be awakened by the application of sensory or other stimuli. It is composed of multiple phases or stages, ranging from the lightest to the deepest.[1,2]

For research purposes, sleep has been divided into two types according to entirely different characteristics: non rapid eye movement (non-REM), where very strong, slow-frequency brain waves occur, and rapid eye movement (REM) whose main feature is the presence of rapid eye movements despite the individual is still asleep. Most of the night sleep belongs to the deep and restorative non-REM type, which is experienced during the first hour, after being awake for a long time. Conversely, REM sleep occurs in episodes, and makes up about 25 % of the sleep cycle of young people. These episodes usually repeat cyclically every approximately 90 minutes and are characterized by being not so restorative. They are also commonly associated with vivid dreams.[2]

Appropriate definition of behavioral characteristics of sleep: 1) reduced awareness and responsiveness to external stimuli, 2) easily reversible process, 3) relative association with muscle immobility and relaxation, 4) occurrence with a circadian (daily) periodicity, and 5) adoption of a stereotyped posture. Absence of sleep (deprivation) induces various behavioral and physiological alterations. In addition, as sleep deprivation accumulates, it will eventually need to be made up.[3,4]

Sleep is not just a phenomenon; it is considered a physiological process of vital importance for the overall health of humans beings.[5] Through multiple pathways, it is considered as a necessary component for the restoration and balance of adequate levels of brain activity.[2] From a behavioral point of view, it can be said that sleep depends on four completely different dimensions: circadian time (time of day in which it occurs); intrinsic factors of the organism (age, sex, sleep patterns, physiological state or need to sleep, etc.); behaviors that facilitate or inhibit sleep; and, finally, the environment. The latter two dimensions, which includes the set of practices necessary to maintain night´s sleep and ensure a normal daytime wakefulness.[6]

Sleep hygiene theories analyze how the effects of certain environmental factors (light, noise, temperature, etc.) and factors related to the individual´s health (nutrition, physical activity, and consumption of certain substances) impact on the sleep quality. It is well known that exposure to noise or extreme temperatures have negative effects on sleep architecture. The type of nutrition also has direct effects; for example, vitamin B, calcium and tryptophan promote this type of activity. Excessive consumption of psychoactive substances (alcohol, caffeine, nicotine, etc.) also alters sleep pattern. This also applies to many hypnotics, including barbiturates and benzodiazepines.[6,7]

The effects of sleep are not limited to the body (neurological restoration and health). They also influence the normal functioning of an individual in society, and directly impact on work or school performance, psychosocial functioning, road safety, among others. One of the factors that can be affected by the decrease in sleep hours is "quality", which not only refers to the act of sleeping at night but also includes an effective daytime functioning.[6,7]

The sleep quality implies one of the most widespread and least understood clinical aspects. Therefore, it is necessary to know about its incidence and the factors that may influence it.[7] It is known that poor sleep quality directly affect the quality of human life, as it seems to be related to increased morbidity due to autonomic dysfunction, psychiatric disorders, traffic and workplace accidents, premature aging, kidney failure, depression, glucose intolerance, and hypercholesterolemia. Poor sleep may also be associated with poor work performance, among others. Currently there is evidence showing that sleeping less than 7 hours is strongly associated with overall mortality, mainly due to cardiovascular problems and type II Diabetes *Mellitus*. It has been confirmed that both subjects who sleep excessively (more than 9 hours) and those who sleep little (less than 7 hours) experience a reduced life expectancy, mainly due to the development of cardiovascular diseases and cancer, especially in women. Problems of duration and/or sleep quality are closely related to chronic, non-communicable diseases. Therefore, poor sleep quality is a significant component of human health vulnerability.[8]

Based on duration, various sleep patterns have been created for the general population, including short (an average of 6 hours or less per night), long (more than 9 hours per night) and medium (between 6-9 hours per night). Even so, a fourth type of sleep patterns could be added for those individuals with a variable sleep pattern, characterized by the inconsistency of their sleeping habits. The reason for such individual variations in sleep duration remains unknown, and there is an ongoing debate about whether seven or eight hours of sleep are actually sufficient for physical, mental and social well-being or, instead, each person must meet his/her

"individual sleep requirement". However, experimental data assert that partial sleep deprivation and/or poor sleep quality have negative effects on drowsiness, motor and cognitive performance, mood or emotional state, as well as on metabolism and hormonal variables. On the other hand, there is evidence that increasing sleep by 2-3 hours has marginal benefits in subjects. [8,9]

The existence of scales designed to assess the characteristics of cognitive functioning and behavior allows the collection of data that guide diagnosis, especially in the area of mental health and neuroscience. There are numerous scales that have been developed across various domains within the health field. These scales range from the measuring altered behavior states to personality disorders. They also include instruments that assess the quality of life in patients with conditions such as cancer, as well as scales that measure emotional states. [10]

The study of sleep should not be limited to the act of sleeping well at night, but it should also include the assessment of effective daytime functioning. The subjective report from the patient is of paramount importance in sleep disturbances. For example, the definition of insomnia includes subjective discomfort related to sleep initiation or maintenance; however, these appreciations vary among individuals.

The concept of sleep quality is a construct that can be assessed using self-report scales. The resulting items vary according to the individuals surveyed. This type of assessment is mainly subjective and includes quantitative aspects such as sleep duration, the number of awakenings, and sleep latency. It also includes qualitative aspects such as restfulness, mood or dream content. Considering the impact of sleep quality on mental health and the challenges associated with its accurate definition and measurement, there is a need for assessment tools that can reduce subjectivity bias. Some existing scales require individuals to respond retrospectively based on what they remember about their sleep quality over the past month. The body of knowledge on this subject has been applied in the development of scales designed to evaluate sleep characteristics and disorders in children, adolescents and adults. [10]

Among the most commonly used instruments to assess sleep quality, the Pittsburgh Sleep Quality Index or PSQI (*Pittsburgh Slepp Quality Test*) [11] has played a leading role. Originally from the United States, year 1989, it is a self-administered questionnaire consisting of 19 items plus 5 questions for the bed partner. These additional questions serve as clinical information, but do not contribute to the total score of the index.

University students usually have an irregular sleep pattern characterized by inconsistencies in the beginning and end of their study sessions, often occurring later than in other people. In addition, they use weekends and other relaxation times, which negatively affects their health. This pattern usually compromises attention, memory, problem-solving abilities, and academic performance of these young adults. Considering the direct influence on cognitive development, significant studies on this matter agree that sleep should be a major concern for university students, especially for those whose academic performance is a priority. [8] The situation is even worse when students in health sciences are involved. Their schedule is irregular, the academic workload is heavy, and they have to attend night shifts. Specifically in medical students, sleep deprivation has been associated with the decline of multiple cognitive variables, such as attention, memory, processing speed and reasoning. [12,13,14]

Objective: to evaluate the sleep quality of third-year medical students from two health sciences faculties.

METHODS
Study context and classification
An observational, descriptive, cross-sectional study conducted in two health sciences faculties.

Sample
The study involved 312 third-year students from two health sciences faculties.

Ethical considerations
During the course of this research, the Ethical principles for medical research involving human subjects were followed, as established in the Declaration of Helsinki [15] which contemplates the four basic ethical principles: respect for the individual, beneficence, non-maleficence and justice.

The surveys were anonymous and administered after obtaining informed consent. Researchers assured participants that their data would not be disclosed to third parties and that only those involved in the study would handle the information. Additionally, participants committed to not disclosing any data that could lead to the identification of the respondents.

The results of the assessment of the evaluation instruments were collected in a database, which remained under the care of the person responsible for the research.

Data collection techniques and procedures
Sources of information
Information was obtained from primary sources, in this case, the survey administered to the students. The

statistical procedure was performed using Exel and MedCalc. The results are summarized and presented in tables and graphs.

Evaluation instrument

The Pittsburgh Sleep Quality Index[11] consists of 19 items plus 5 questions for the bed partner. These additional questions serve as clinical information, but do not contribute to the total score of the index. The 19 items analyze various determinants of sleep quality, grouped into seven components: quality, latency, duration, efficiency and sleep disturbances, use of sleep medication and daytime dysfunction. Each component is scored on a scale from 0 to 3. In all cases a score of 0 indicates mild, while a score of 3 indicates severe difficulty. The total score of the PSQI is obtained from the sum of the seven components. It ranges from 0 to 21 points (the higher the score, the poorer the sleep quality). Buysse proposes a cut-off point of 5 (a score ≥ 5 defines poor sleepers).

The questionnaire is short, simple and well-accepted by patients. In the general population, it can be used as a screening tool to detect "good" and "poor" sleepers. It can guide the clinician on the most impaired components of sleep. It allows the monitoring of the natural history of sleep disorder in patients, the influence of sleep disturbances on the course of psychiatric processes and the response to specific treatments, among others.

Internal consistency, measured by Cronbach's alpha, was high for the 19 items as well as for the 7 components. Item scores, components scores and overall value remained stable over time (test-retest). This findings have allowed their validation not only in psychiatric patients but also in the general population, with a sensitivity of 89,6 % and a specificity of 86,5 %. [16,17,18,19]

RESULTS

Table 1. Subjective sleep quality					
Subjective quality	**Faculties**			**General**	
	Faculty 1		**Faculty 2**		
	N	**%**	**N**	**%**	**N**	**%**
Does not exist	30	23,26 %	36	19,67 %	66	21,15 %
Mild	72	55,81 %	84	45,90 %	156	50,00 %
Moderate	27	20,93 %	57	31,15 %	84	26,92 %
Severe difficulty	-	-	6	3,28 %	6	1,92 %
Total	129	100 %	183	100 %	312	100 %

Table 2. Sleep latency					
Sleep latency	**Faculties**			**General**	
	Faculty 1		**Faculty 2**		
	N	**%**	**N**	**%**	**N**	**%**
Does not exist	30	23,26 %	51	27,87 %	81	25,96 %
Mild	48	37,21 %	51	27,87 %	99	31,73 %
Moderate	45	34,88 %	60	32,79 %	105	33,65 %
Severe difficulty	6	4,65 %	21	11,48 %	27	8,65 %
Total	129	100 %	183	100 %	312	100 %

Table 3. Duration of sleep					
Duration of sleep	**Faculties**			**General**	
	Faculty 1		**Faculty 2**		
	N	**%**	**N**	**%**	**N**	**%**
Does not exist	24	18,60 %	18	9,84 %	42	13,46 %
Mild	45	34,88 %	63	34,43 %	108	34,62 %
Moderate	45	34,88 %	66	36,07 %	111	35,58 %
Severe difficulty	15	11,63 %	36	19,67 %	51	16,35 %
Total	129	100 %	183	100 %	312	100 %

Table 4. Habitual sleep efficiency						
Habitual sleep efficiency	Faculties				General	
	Faculty 1		Faculty 2			
	N	%	N	%	N	%
Does not exist	90	69,77 %	129	70,49 %	219	70,19 %
Mild	18	13,95 %	21	11,48 %	39	12,50 %
Moderate	15	11,63 %	21	11,48 %	36	11,54 %
Severe difficulty	6	4,65 %	12	6,56 %	18	5,77 %
Total	129	100 %	183	100 %	312	100 %

Table 5. Sleep disturbances						
Sleep disturbances	Faculties				General	
	Faculty 1		Faculty 2			
	N	%	N	%	N	%
Does not exist	90	69,77 %	12	6,56 %	102	32,69 %
Mild	18	13,95 %	138	75,41 %	156	50 %
Moderate	21	16,28 %	33	18,03 %	54	17,31 %
Severe difficulty	-	-	-	-	-	-
Total	129	100 %	183	100 %	312	100 %

Table 6. Use of hypnotic drugs						
Use of hypnotic drugs	Faculties				General	
	Faculty 1		Faculty 2			
	N	%	N	%	N	%
No existe	114	88,37 %	12	6,56 %	126	40,38 %
Leve	12	9,30 %	138	75,41 %	150	48,08 %
Moderada	3	2,33 %	33	18,03 %	36	11,54 %
Grave dificultad	0	0,00 %	0	0,00 %	0	0,00 %
Total	129	100 %	183	100 %	312	100 %

Table 7. Diurnal dysfunction						
Diurnal dysfunction	Faculties				General	
	Faculty 1		Faculty 2			
	N	%	N	%	N	%
Does not exist	21	16,28 %	24	13,11 %	45	14,42 %
Mild	45	34,88 %	51	27,87 %	96	30,77 %
Moderate	30	23,26 %	63	34,43 %	93	29,81 %
Severe difficulty	33	25,58 %	45	24,59 %	78	25 %
Total	129	100 %	183	100 %	312	100 %

Table 8. Pittsburgh Sleep Quality Index (PSQI) overall rating						
PSQI	Faculties				General	
	Faculty 1		Faculty 2			
	N	%	N	%	N	%
Good sleepers	39	30,23 %	51	27,87 %	90	28,85 %
Poor sleepers	90	69,77 %	132	72,13 %	222	71,15 %
Total	129	100 %	183	100 %	312	100 %

Table 9. Pittsburgh Sleep Quality Index according to sex											
Sex	Faculties								General			
	Faculty 1				Faculty 2							
	Good sleepers		Poor sleepers		Good sleepers		Poor sleepers		Good sleepers		Poor sleepers	
	N	%	N	%	N	%	N	%	N	%	N	%
Male	24	27,59 %	63	72,41 %	36	30 %	84	70 %	60	55,05 %	49	44,95 %
Female	15	35,71 %	27	64,29 %	15	23,81 %	48	76,19 %	30	54,55 %	25	45,45 %
Total	39	30,23 %	90	69,77 %	51	27,87 %	132	72,13 %	90	28,85 %	222	71,15 %

Table 10. Substance consumption						
Substance consumption	Faculties				General	
	Faculty 1		Faculty 2			
	N	%	N	%	N	%
Consume	3	2,33 %	111	60,66 %	114	36,54 %
Does not consume	126	97,67 %	72	39,34 %	198	63,46 %
Total	129	100 %	183	100 %	312	100 %

Table 11. Mann-Whitney analysis of the mean scores of non-consumers and consumers in the different scores of the Pittsburgh Sleep Quality Index				
	Non-consumers (n = 198)	*Consumers (n = 114)*	*U*	*p*
Subjective sleep quality	1,00 (0,63)	1,49 (0,83)	498,00	0,010**
Sleep latency	1,35 (1,14)	2,06 (0,99)	473,00	0,007**
Sleep duration	0,81 (0,83)	0,87 (0,85)	700,00	0,756
Habitual sleep efficiency	0,42 (0,89)	0,49 (0,78)	649,00	0,321
Sleep disturbances	1,10 (0,54)	1,45 (0,54)	503,50	0,008**
Use of hypnotic drugs	0,26 (0,73)	0,53 (1,08)	660,50	0,295
Diurnal dysfunction	1,45 (0,96)	1,87 (0,97)	548,00	0,055*
Total score	6,45 (3,81)	8,77 (4,03)	480,00	0,011**
* p<0,05; *** p<0,001; ** p<0,01				

DISCUSSION

Sleep disorders are one of the most significant health problems in Western societies. The importance of a good sleep quality is not only fundamental as a determinant of health but also as an element conducive to a good quality of life. Sleep quality does not only refer to sleeping well at night but also also involves an effective daytime functioning, including an appropriate level of attention to perform various tasks. This makes it essential to study the incidence of these disorders in various types of populations.

The discussion of the study focused on the two initially set objectives: to study the incidence of sleep disorders in a sample of university students and to evaluate the effects of consuming certain substances on sleep quality. Subjective sleep quality was assessed in a sample of healthy university students with no serious medical or psychological disorders. They appeared to have normal daytime functioning.

The first relevant finding is that approximately one-third of the sample presents significant sleep difficulties; thus, 1,92 % subjectively rate their sleep quality as poor and 17,31 % report a sleep efficiency below 85 % which is the percentage commonly used for diagnosing insomnia. These data are similar to that provided by other authors who report that approximately 30 % of the population experiences insomnia problems. [20,21]

In a study conducted with a similar sample, Vera, Maldonado and Navarro[22] reported significantly lower percentages: 17 % reported they had poor sleep quality, while 18 % reported sleep efficiency below 85 %. The 30 % percentage found increases when latency of the sleep is considered, as exactly half of the sample reports taking more than 30 minutes to fall asleep, and 19 % of them taking over an hour. This percentage closely aligns with the 12 % reported by Vera *et al*.[22], and the 10 % mentioned by Domínguez, Soler, Gómez, Rubio y Benetó.[23] Besides, in a study conducted by García de León Alvarez y Robles Sánchez,[24] with a sample of young adults, it was reported that 36,7 % take more than 20 minutes to fall asleep. The above evidence indicates that

difficulties in initiating sleep are more frequent in young people, while in the elderly, nighttime awakenings and early morning awakenings are more common.[24,25]

Regarding the consumption of hypnotics, 13 % of the sample reported having consumed these substances in the last month to facilitate sleep. This percentage is very similar to the 14,5 % found by Domínguez et al.[25]. Although the Pittsburgh Sleep Quality Index does not provide us with specific information about the type of hypnotic drugs consumed, we estimate that the most commonly used pharmacological group for this condition is benzodiazepines. These drugs are easily available to the sample, as observed in other studies conducted in the Spanish population.[26,27]

Considering the total score on the Pittsburgh Sleep Quality Index and taking into account that the score of 5 is the cut-off point for differentiating good sleeping subjects from poor sleeping subjects, we found that 60,33 % of the sample would be defined as poor sleepers compared to 39,66 % as good sleepers. This percentage of poor sleepers is higher than the 48,2 % found by Vera et al[22].

These results highlight the absence of sex differences in subjective quality, latency, duration and sleep efficiency, as well as in sleep disturbances and daytime dysfunction. However, it is considered that complaints of insomnia are more frequent in women than in men.[23,24] This is probably attributed to the age of the sample (mean 20,92 years), as sex differences tend to become more evident as the years pass by. On the other hand, it has been found that women consume more hypnotics than men, even though scores obtained in both sexes are not remarkable high. The higher consumption by women is clearly documented in the literature, both in the general population[28] and in the elderly.[29] Although there are various factors at play, the higher incidence of anxiety disorders in women could provide an explanation for this tendency.

If we analyze the scores obtained in the various components of the Pittsburgh Sleep Quality Index instead of percentages, and taking into account that the score ranges from 0 (absence of disorder) to 3 (presence of disorder), we observe that the evaluated subjects exceed the mean value (1,5) in sleep latency (1,57) and daytime dysfunction (1,50). This would confirm again that excessive sleep latency is a characteristic of young subjects with sleep problems.[28] Excessive daytime sleepiness, as evaluated using the Epworth Sleepines Scale, is also reported in the study of Domínguez et al.[9] Other components approaching the value of 1,5 are subjective sleep quality (1,15) and sleep disturbances (1,23).

With regard to the effect of alcohol, caffeine and nicotine, it is clearly demonstrated that excessive use is extremely negative for sleep quality. In 2000, Irwin et al.[16] reported significant disorders in the sleep patterns of a sample of alcoholics subjects, particularly a reduction in slow-wave sleep. On the other hand, Foster and Peters [12,19] administered the Pittsburgh Sleep Quality Index to a sample of alcoholic patients. They found a poor sleep quality with no significant differences among severe, moderate and occasional alcoholics. Caffeine intake minutes before bedtime increases latency and night awakenings, reduces overall sleep time and slow-wave sleep, and impairs subjective sleep quality.[33,35] Although there are significant individual differences in sensitivity and tolerance, it is known that daily excessive consumption, i.e. above 300 milligrams, causes sleep disturbances.[30] Similarly, nicotine, due to its stimulating properties, has sleep-disruptions effects similar to those found in caffeine. However, some people find that smoking a cigarette induces a beneficial state of relaxation, because low amounts of nicotine in the bloodstream can cause mild sedation. On the other hand, the effect of consuming large amounts of this stimulant causes a physiological activation because nicotine increases blood pressure and stimulates the brain. It is worth mentioning that the effect of the social use of these substances on sleep is less known.

In our study we have defined regular users as subjects who drank alcohol two and four times per day, between two and four cups of coffee per day, or who smoked between 20 and 30 cigarettes. The criteria used to establish this definition have been arbitrary, and we presume that this level of consumption does not imply a clinically significant disorder for the subjects. Otherwise, such consumption would cease to be social to become an addictive behavior. In these subjects, as with patients diagnosed as dependent, the sleep quality differs from that of those who do not consume these substances. Thus, the sample of social consumers shows a lower subjective sleep quality, increased latency, a higher number of disturbances, and a greater daytime dysfunction compared to non-consumer subjects. Landolt, Werth, Borbely, and Dijk obtained similar results using objective measures, and they reported alterations in the sleep EEG in subjects who had consumed 200 milligrams of caffeine in the morning.[30]

CONCLUSIONS

The study reveals that approximately 70 % of the subjects have poor sleep quality, which is further impaired by alcohol, coffee and tobacco consumption. This shows that, in addition to the various negative effects of excessive consumption of these substances, we must also consider poor sleep quality as another one.

The majority of university students who participated in the study perceive a poor sleep quality. Relevant alterations (ranging from moderate to severe) in the attentional processes are found in selective attention and in divided attention. According to the total sleep quality score index and its relationship with the attentional

processes analyzed, a remarkable relationship is found between the total sleep quality score index and the alterations in selective attention, as well as between the total sleep quality score index and alterations in selective attention (moderate to severe). With regard to sustained and divided attention processes, high averages are observed in the scores that reflect the subjective sleep quality, but not in the total sleep quality score.

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FINANCING

CONFLICT OF INTEREST
The authors declare that there are no conflicts of interest.

CONTRIBUTION OF THE AUTHORS
Conceptualization: Javier González Argote.
Research: Javier González Argote.
Methodology: Javier González Argote.
Original drafting: Javier González Argote.
Revision and editing: Javier González Argote.