






# Processed and ultra-processed foods consumption in adults and its relationship with quality of life and quality of sleep

## *Consumo de alimentos processados e ultraprocessados em adultos e sua relação com qualidade de vida e qualidade do sono*

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### ABSTRACT

#### Objective

To evaluate the consumption of processed and ultra-processed foods in Paraguayan adults and its relationship with quality of life and sleep quality.

#### Methods

A cross-sectional descriptive observational study was carried out on Paraguayan adults in May 2022. An online survey was applied in which sociodemographic data, frequency of food consumption using the NOVA classification and Pan

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American Health Organization criteria, quality of life evaluated by the European Quality of Life-5 Dimensions and report of hours of sleep were collected.

### Results

A total of 273 Paraguayan adults were included in the study, of which 71.1% were female, 51.6% lived in the capital, 53.1% were single, 66% had a university educational level and the average age was  $36.48 \pm 13.2$ . Regarding the consumption of processed and ultra-processed foods, the critical nutrients most consumed daily were free sugars by 34.0%, and fats by 23.4% of the population. The global quality of life index was low ( $0,58 \pm 0,05$ ) and 69.0% reported insufficient hours of sleep. Statistically significant relationships were found between the consumption of processed and ultra-processed foods with quality of life and quality of sleep ( $p < 0.05$  for both).

### Conclusion

The most consumed critical nutrients in the Paraguayan adult population are free sugars and fats, finding a significant relationship between the consumption of processed and ultra-processed foods with quality of life and quality of sleep.

**Keywords:** Hours of sleep. Processed foods. Quality of life. Ultra-processed foods.

## RESUMO

### Objetivo

Avaliar o consumo de alimentos processados e ultraprocessados em adultos paraguaios e sua relação com a qualidade de vida e qualidade do sono.

### Métodos

Foi realizado um estudo observacional descritivo transversal em adultos paraguaios em maio de 2022. Foi aplicado um questionário online onde foram questionados dados sociodemográficos, frequência de consumo alimentar pela classificação NOVA e critérios da Organização Pan-Americana da Saúde, qualidade de vida avaliada pelo Qualidade de Vida Europeia-5 Dimensões - foram coletados e relato de horas de sono.

### Resultados

Foram incluídas no estudo 273 paraguaios, das quais 71,1% eram do sexo feminino, 51,6% residiam na capital, 53,1% eram solteiras, 66,0% tinham nível universitário e a média de idade foi de  $36,48 \pm 13,2$  anos. Em relação ao consumo de alimentos processados e ultraprocessados, os nutrientes críticos mais consumidos diariamente foram os açúcares livres por 34,0% e as gorduras por 23,4% da população. O índice global de qualidade de vida foi baixo ( $0,58 \pm 0,05$ ) e 69,0% relataram horas insuficientes de sono. Foram encontradas relações estatisticamente significativas entre o consumo de alimentos processados e ultraprocessados com qualidade de vida e qualidade do sono ( $p < 0,05$  para ambos).

### Conclusão

Os nutrientes críticos mais consumidos na população adulta paraguaia são os açúcares e gorduras livres, encontrando uma relação significativa entre o consumo de alimentos processados e ultraprocessados com a qualidade de vida e qualidade do sono.

**Palavras-chave:** Horas de sono. Alimentos procesados. Qualidade de vida. Alimentos ultraprocessados.

## INTRODUCTION

Processed and Ultra-Processed Foods (UPF) are concepts that are used to refer to unhealthy diets and that are increasingly gaining space within the characterization of the type of diet of the general population [1-5].

Systematic reviews and meta-analyses have shown the association between the consumption of this type of food with excessive weight gain and obesity [6]. In addition, the excessive and chronic consumption of these foods promotes the development of cardiovascular diseases, metabolic syndrome, cerebrovascular diseases, diabetes and even depression. The cardiometabolic profile of people who excessively consume

this type of food is characterized by greatly reduced High-Density Lipoprotein (HDL) levels, increased waist circumference, and increased risk of all-cause mortality [7].

One of the key points in the identification of processed and UPF is their characterization and classification. In 2009, a Brazilian research group concluded that people who consumed this type of food had an unbalanced eating profile that could be harmful to their health based on the results of two studies on the 25-year food acquisition trend in Brazil [8-10]. The authors revealed that those people who consumed this type of food had an unbalanced eating profile that could be harmful to their health. Based on the data obtained by this research, a food classification system was developed according to its degree of processing called NOVA. This classification system is based on the degree and purpose of processing. This food stratification allowed other researchers in the area of nutrition to obtain data showing that the consumption of processed and UPF contributes from 30% to 50% of the daily diet of high and middle-income populations [11,12].

Globally, a review by Baker *et al.* [13] which included 38 high-income countries, 26 high-middle income countries, and 16 low-middle income countries, found that the sale of UPF is higher in richer and increasing countries as they get richer, in addition, sales were highest in Australasia, North America, Europe and Latin America, but are increasing in Asia, the Middle East and Africa.

There are three studies on the nutritional composition of processed and UPF according to the food profile of the Pan American Health Organization (PAHO) with emphasis on critical nutrients carried out in Paraguay in foods intended for the adult population, children and the celiac. The results obtained revealed that all foods had at least one critical nutrient that exceeds what is established by PAHO [14-16].

On the other hand, quality of life involves various factors such as lifestyle, sleep, diseases, diet, and nutritional status in the final result which is the well-being of each individual [17]. In particular, dietary patterns are closely related to different lifestyles, as has been shown through several prospective cohort studies [18]. A dietary pattern, characterized by high consumption of UPF, is associated with a poor quality of life and even with a higher rate of mortality from all causes [19,20].

Sleep is related to virtually all aspects of health and daily function [21-23]. Diet is a modifiable behavior that could affect sleep quality [24]. For example, it has been shown that adults with higher adherence to a Mediterranean diet pattern were less likely to have objectively measured short sleep duration, as well as fewer symptoms of insomnia [25].

In view of the lack of studies on the quality of life and sleep resulting from the consumption of this type of food in adults, the present work aims to evaluate the consumption of processed and UPF in Paraguayan adults and their association with the quality of sleep and quality of life of them.

## **METHODS**

An observational, analytic, cross-sectional study was conducted. The sample was non-probabilistic (accidental) and consisted of 273 Paraguayan adults between 18 and 60 years of age. Subjects were invited to participate in the study in May 2022. Participation in the study was voluntary and anonymous through an online survey using the Google Docs forms tool. The invitation was made through different media, such as social networks, and personal and institutional emails. Before completing the online questionnaire, each volunteer had to read the objective of the study, the use and management that would be made of the data obtained, and explicitly give their informed consent.

The research protocol was developed in accordance with the guidelines of the Declaration of Helsinki in relation to research involving human subjects and was approved by the Scientific and Ethics Committee of the Paraguayan Association of Graduates in Nutrition (Code nº 135/2022).

The questionnaires used were prepared by the authors in order to obtain the data presented here. Demographic data such as gender, age, origin, educational level, food consumption through a frequency survey of daily and weekly consumption of processed and UPF, quality of life variables measured through the EuroQoL-5D questionnaire and variables on self-report hours of sleep (optimal; 9 or more hours, borderline; between 8 and 9 hours and insufficient; less than 8 hours).

The survey consisted of 14 questions and a food consumption frequency table that included 32 processed (white bread, wholemeal bread, canned items, cheese) and UPF (French fries snacks, ham and cheese snacks, corn snacks, nachos, gummy bears, cookies, chocolates, pastries, *alfajores*, instant soups, chocolate powder, juice powders, instant mashed potatoes, breakfast cereals, packaged juices, nectars, energy drinks, rice pudding, yogurt, jams, sweeteners, sausages, nuggets, frozen pizza, frozen potatoes, savory snacks, fried foods, fast food) based on the NOVA classification that were selected for being the most consumed by the Paraguayan adult population; then, they were classified into 5 subgroups of critical nutrients based on the PAHO Critical Nutrient Profile Model: sodium, free sugars, saturated and trans fats, and nitrites and nitrates, indicating the frequency of consumption in the last six months [26,27]. The frequency options were the following: weekly consumption (1-2, 3-4 and 5-6 times a week), or daily consumption (1, 2, 3 and 4+ times a day), from both amounts the cumulative weekly consumption frequency was calculated, and it was divided into three categories (does not consume, 2 to 3 times per week and daily).

Quality of life evaluation was carried out using the EuroQoL-5D, which consists of five dimensions (mobility, personal care, daily activities, pain/discomfort and anxiety/depression), which are scored according to the response of the interviewee and whose sum gives the value of the Global Quality of Life Index, which below the value 1 is considered to be relatively low and as the value decreases, the quality of life is lower [28].

For normality tests, the Kolmogorov-Smirnov and Shapiro-Wilk tests were performed with a significance level of  $\alpha < 0.05$ . To determine the differences between the variables, the Chi Square test was used. A significant *p* value of less than 0.05 was considered. The statistical package used was SPSS®IBM® (version 21.0) for Windows.

## RESULTS

A total of 273 people participated in the study, of which 71.1% were female, 51.6% lived in the capital, 53.1% were single, 66% had a university education and the average age was  $36.48 \pm 13.2$  years (Table 1).

Regarding the consumption of critical nutrients through processed and UPF in the present study population, we observed that the frequency of intake of foods with a high sodium content was 2-3 times a week in 61.0%, the consumption of foods high in free sugars was every day in a 34.0%, the intake of foods with a high fat content was every day in 23.4% and the consumption of foods high in nitrites and nitrates was every day in 35.5% (Table 2).

The quality of life according to the EuroQoL-5D questionnaire according to its 5 dimensions found that in terms of mobility and personal care, the majority of individuals had no problems (92.0% and 98.0%, respectively). On the other hand, in terms of daily activities, 4.4% of individuals with some problems were observed. In addition, 33.3% of individuals were found to have moderate pain or discomfort in this dimension and 44.3% of the population reported having moderate anxiety and depression. When evaluating the Quality of Life Index, a score of  $0.58 \pm 0.05$  was found (Table 3). The hours of sleep were mostly insufficient, at a proportion of 69.0% (Table 4).

**Table 1** – Sociodemographic characteristics. Paraguay, 2022.

Variable	n	%
Gender		
Male	78	28.5
Female	194	71.1
Other	1	0.4
Total	273	100
Origin		
Asunción	141	51.6
Gran Asunción	99	36.3
Interior del país	33	12.2
Total	273	100
Marital status		
Married	102	37.3
Single	145	53.1
Divorced	15	5.5
Widow	4	1.6
Other	7	2.5
Total	273	100
Education level		
Primary	0	0.0
High school	34	12.4
College	180	66.0
Postgraduate	59	21.6
Total	273	100
Age (Mean±SD)	36.48±13.2	

**Table 2** – Consumption of critical nutrients through processed and ultra-processed foods. Paraguay, 2022.

Critical nutrient	Frequency						Total	
	Does not consume		2-3 times/week		Daily		n	%
	n	%	n	%	n	%		
Sodium	80	29.3	166	61.0	27	9.7	273	100
Free sugars	44	15.8	137	50.2	92	34.0	273	100
Fat	26	9.6	183	67.0	64	23.4	273	100
Nitrites and nitrates	83	30.4	93	34.1	97	35.5	273	100

**Table 3** – Quality of life according to EuroQoL-5D dimensions. Paraguay, 2022.

1 of 2

Dimension	n	%
Mobility		
I have no problem walking	251	92.0
I have some trouble walking	22	8.0
I have to be in bed	0	0.0
Total	273	
Personal care		
I have no problems with personal care	267	98.0
I have some trouble washing or dressing myself	5	1.8
I am unable to wash or dress myself	1	0.2
Total	273	

**Table 3** – Quality of life according to EuroQol-5D dimensions. Paraguay, 2022.

2 of 2

Dimension	n	%
Daily activities		
I have no problems doing my daily activities	261	95.6
I have some problems doing my daily activities	12	4.4
I am unable to carry out my daily activities	0	0.0
Total	273	100
Pain/discomfort		
I have no pain or discomfort	179	65.5
I have moderate pain or discomfort	91	33.3
I have a lot of pain or discomfort	3	1.2
Total	273	100
Anxiety/Depression		
I am not anxious or depressed	140	51.3
I am moderately anxious and depressed	121	44.3
I am very anxious and depressed	12	4.4
Total	273	100
Global quality of life index (Mean±SD)	0.58±0.05	

**Table 4** – Hours of sleep. Paraguay, 2022.

Hours of sleep	n	%
Optimum	13	4.7
Borderline	72	26.3
Insufficient	188	69.0
Total	273	100

To perform the analysis of the association between the consumption of processed and UPF with quality of life and sleep, the population was classified into three categories of consumption: no consumption, moderate consumption, excessive consumption (does not consume, 2 to 3 times a week and daily). Statistically significant differences were found between the categories of consumption and the global index of quality of life and hours of sleep (Table 5).

**Table 5** – Consumption of processed and ultra-processed foods in relation to quality of life and hours of sleep. Paraguay, 2022.

Variable	Consumption of processed and ultra-processed foods						Total		p*
	Does not consume		Moderate		Excessive		n	%	
	n	%	n	%	n	%			
Global quality of life index									
Low	40	22.0	90	50.0	50	28.0	180	65.9	
Normal	18	19.4	55	59.1	20	21.5	93	34.1	
Total	58	22.1	145	48.2	70	29.7	273	100	<0.001
Hours of sleep									
Optimum	36	59.0	15	25.0	10	16.0	61	22.4	
Borderline	6	18.8	10	31.2	16	50.0	32	11.5	
Insufficient	21	11.0	102	57.0	57	32.0	180	66.0	
Total	63	23.0	127	46.5	83	30.5	273	100	0.033

Note: \*Chi squared.

## DISCUSSION

A total of 273 people were evaluated, of which 71.1% were female, an amount lower than the 89.0% of women found in the study by Meza-Miranda and Giménez [29] on the “Level of physical activity and quality of life associated with health in Paraguay adults”. 51.6% of those surveyed lived in the country's capital, in contrast to the aforementioned study, where 24.3% lived in Asunción [29]. The mean age of the study population was  $36.48 \pm 13.2$  years, similar to that found by Meza-Miranda and Giménez, with a mean age of  $34.6 \pm 10.6$  years [29].

Regarding the frequency of consumption of processed and UPF, taking into account the critical nutrients of the NOVA classification and the PAHO criteria, the consumption of foods with a high sodium content was moderate to high in 61% of the population, a proportion that exceeds the 8% found in the study by Vázquez *et al.* [30]. In another study conducted by Vargas-Meza *et al.* [31] in a sample of 1,356 Mexican adults regarding sodium intake from foods that were mostly ultra-processed, they showed a daily consumption of 3,132 mg/day, a figure that far exceeds the established intake limit, thus demonstrating that these types of foods are the main source of this critical nutrient. One of the main sodium sources is processed and UPF, which provides almost half of the daily amount allowed by the World Health Organization (WHO) in adults that must be less than 2 g/day. This is why it is extremely important to identify this type of food within the daily diet of people, in order to quantify the amount of sodium they provide [32-35].

The consumption of free sugars was 34.0% on a daily basis, that is, at least one portion every day, in contrast to 47.0% of daily consumption in the population of the study by Vázquez *et al.* [30]. In another study carried out by Olmedo *et al.* [36] in Argentine adults, the consumption of free sugars from UPF was evaluated and a consumption of up to 36.4% was found, far exceeding the limits established for this critical nutrient. Different advisory bodies such as the WHO recommend consumption of free or added sugars of less than 10.0% of energy intake, while the United Kingdom guidelines go further by advising that the intake of free sugars does not exceed 5.0% of the energy intake [37].

The daily consumption of fats from foods rich in saturated fats and trans fats was 23.4%, an amount that greatly exceeds the 6.0% found by Vázquez *et al.* [30]. Eating foods high in saturated and trans fats increases the risk of cardiovascular disease and even cancer, as well as increasing the risk of all-cause mortality [38]. The WHO in its guidelines recommends the daily consumption of saturated fats at less than 10.0% of the total caloric value and less than 1.0% of trans fats of the total caloric value. In addition, it recommends replacing these fats with healthier ones, such as polyunsaturated and monounsaturated acids [39].

35.5% of those surveyed reported daily consumption of foods with a high content of nitrites and nitrates, a proportion that exceeds the 13.0% observed in the study population of Vázquez *et al.* [30]. The most frequent use given to nitrates and nitrites is as a food additive and preservative for sausages and other types of processed meats, giving better flavor and appearance to the food and delaying microbial deterioration. The chemical reactions of nitrites, nitrates and other types of proteins result in the production of nitrosamines such as N-nitrosodimethylamine, which is a potent carcinogen, known to promote the appearance of tumors in the liver, stomach and lungs [40].

On the other hand, the global index of quality of life evaluated by the EuroQoL-5D was  $0.58 \pm 0.05$ , lower than that found by Meza-Miranda and Giménez [29], with a global index of  $0.67 \pm 0.5$ . When analyzing the quality of life according to the five dimensions of the EuroQoL-5D, the most affected were those of pain/discomfort with 33.3% of individuals with moderate pain or discomfort and 44.3% of the population with moderate anxiety and depression, while the study by Meza-Miranda and Giménez [29] found 23.0% of individuals with moderate pain or discomfort and 33.0% of the population with moderate anxiety and

depression. Taking into account that we are currently in the post-Covid-19 pandemic stage, this considerable percentage of people with depression or anxiety is to be expected due to the recent confinement that the country had to go through. The same applies to the pain/discomfort dimension.

Regarding the evaluation of sleep, this research found that 69% of respondents had insufficient hours of sleep. To promote optimal health and wellness, it is recommended that adults ages 18 to 60 get at least 7 hours of sleep each night. Sleeping less than 7 hours a night has been shown to be associated with an increased risk of obesity, diabetes, high blood pressure, coronary heart disease, stroke, frequent mental distress, and all-cause mortality [41].

When analyzing whether there is a relationship between the consumption of processed and UPF and quality of life and quality of sleep, statistically significant differences were found between the categories of consumption and the global index of quality of life and hours of sleep. The lower the quality-of-life index, the greater the consumption of processed and UPF. In addition, the fewer hours of sleep, the greater the consumption of this type of food.

There is evidence of the impact that UPF consumption has on quality of life. For example, Costa *et al.* [42] evaluated the association between lifestyle and quality of life in a population of Brazilian adolescents. The higher the consumption of processed foods, the lower the quality of life reported by the participants in their study [42]. Wu *et al.* [43] conducted a systematic review and meta-analysis that included 17 studies, in which the impact of diet quality on the quality of life in children and adolescents was analyzed. Their main findings were that children and adolescents with a low quality of life had a less healthy dietary profile than those with a higher quality of life and a healthier diet [43].

Regarding sleep quality, Sousa *et al.* showed that those with a higher energy intake from UPF and a lower energy intake from fresh, minimally processed foods had a higher prevalence of poor sleep quality in 2,499 older Brazilian adolescents [44]. A study of 509 Italian children/adolescents showed that the total energy intake from UPF (defined using the NOVA classification) was 25.9%. The increased consumption of ultra-processed foods showed direct links with poor sleep quality [45].

Some of the limitations of the study to be considered are that quantitative data on dietary intake were not considered, which would have provided more specific information in this regard. Lastly, there is some degree of confusion in the NOVA classification and some foods cannot be classified more pertinently.

As a strength of the study, we can mention that it is the first to be carried out in the country that evaluates the consumption of processed and UPF, using a previously validated survey that includes foods for local consumption, whether they are nationally produced or imported, in addition to analyzing how their consumption can be related to the quality of life of the adult population and affect sleep.

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## CONCLUSION

The results demonstrated here reveal that the excessive consumption of processed and UPF is a factor that could have an influence on the quality of life, making it low/bad, and on the quality of sleep, decreasing the daily hours of sleep. Immediate strategies must be implemented to reduce the consumption of this type of food, such as including recommendations within the Food Guides such as those of Brazil and implementing front labeling that indicates to consumers that the product contains excessive amounts of sugars, total fats, saturated fat, trans fat and sodium.



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## CONTRIBUTORS

ER MEZA-MIRANDA was responsible for the conception and design, data analysis and interpretation, revision and approval of the final version of the manuscript. AL BERTHOMIER RODRÍGUEZ, NJ DUARTE AMARILLA, MM TRINIDAD RODRÍGUEZ and BE NÚÑEZ MARTÍNEZ contributed to the Recruitment of participants, data collection and revision and approval of the final version of the manuscript.

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