

Artículo Original / Original Article

## Concomitant use of allopathic medicine and herbal products for weight-loss among people with overweight or obesity from Central Mexico

[Uso concomitante de medicina alopática y productos herbales para bajar de peso en personas con sobrepeso u obesidad del centro de México]

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**Abstract:** This study evaluated the prevalence of concomitant use of herbal products for weight loss (HPWL) and allopathic medicine. Factors associated with the prevalence, adverse reactions, and the alteration of medication adherence with the concomitant use of HPWL alone and in combination with allopathic medicine, were assessed. The study was descriptive and cross-sectional using a questionnaire conducted among people with overweight or obesity (n=662) from five cities of Central Mexico. Adherence to medications was measured using the Morisky Medication Adherence Scale. The prevalence of adverse reactions induced by the concomitant use of HPWL, and allopathic medicine was 25.3%. The use of HPWL affected medication adherence by 68%. There is a high prevalence (45.2%) of concomitant use of HPWL and allopathic medicine in people with overweight or obesity in Central Mexico. The concomitant use of HPWL and allopathic medicine induces adverse reactions, mainly gastrointestinal, and thus, medication adherence is affected.

**Keywords:** Herbal products; Allopathic medicine; Interaction; Obesity; Adverse reactions.

**Resumen:** Este estudio evaluó la prevalencia del uso concomitante de productos a base de hierbas para bajar de peso (HPWL) y medicina alopática. Se evaluaron los factores asociados con la prevalencia, las reacciones adversas y la alteración de la adherencia a la medicación con el uso concomitante de HPWL solo y en combinación con medicina alopática. El estudio fue descriptivo y transversal mediante un cuestionario realizado entre personas con sobrepeso u obesidad (n = 662) de cinco ciudades del centro de México. La adherencia a los medicamentos se midió mediante la Escala de adherencia a la medicación de Morisky. La prevalencia de reacciones adversas inducidas por el uso concomitante de HPWL y medicina alopática fue del 25,3%. El uso de HPWL afectó la adherencia a la medicación en un 68%. Existe una alta prevalencia (45,2%) de uso concomitante de HPWL y medicina alopática en personas con sobrepeso u obesidad en el centro de México. El uso concomitante de HPWL y medicina alopática induce reacciones adversas, principalmente gastrointestinales, y por tanto, afecta la adherencia a la medicación.

**Palabras clave:** Productos a base de hierbas; Medicina alopática; Interacción; Obesidad; Reacciones adversas.

## ABBREVIATIONS LIST

Adverse reactions (ARs)  
 Body mass index (BMI)  
 Herbal products for weight loss (HPWL)  
 Odds ratio (OR)

## INTRODUCTION

Obesity is a serious problem for high-, middle-, and low-income countries. Diseases like diabetes, stroke, and certain cancers (endometrial, prostate, ovarian, kidney, breast, among others) are attributable to overweight and obesity (WHO, 2018). Approximately 2.8 million people die every year because of overweight and obesity (WHO, 2018).

In Mexico, 39% and 36% of adult population is overweight and obese, respectively (ENSANUT, 2020). Rates of obesity are higher in women (40%) than in men (30.5%), whereas rates of overweight are higher in men (42.5%) than in women (36.6%) (ENSANUT, 2020).

In Mexico, the use of herbs for the empirical treatment of many diseases is a common practice (Alonso-Castro *et al.*, 2017). People seek other strategies for weight loss, including the use of herbal products (Ríos-Hoyo & Gutiérrez-Salmeán, 2016). The use of herbal products for weight loss (HPWL) in Mexico was previously reported (Alonso-Castro *et al.*, 2019). The findings showed that overweight and obese participants from Mexico used HPWL (a prevalence of 42.9%) that contain mainly green tea (*Camellia sinensis*), aceitilla, (*Bidens odorata*), and soybean (*Glycine max*). Female gender, low educational level, and middle socio-economic status were the main factors associated to the consumption of these herbal products (Alonso-Castro *et al.*, 2019). These herbal products lack approval by the Secretariat of Health in Mexico.

The concomitant use herb and drug is a current topic of interest. Possible adverse reactions (ARs) in the concurrent herb-drug use have been reported in clinical trials. For instance, *Hypericum perforatum* decreases the blood concentrations of cyclosporin, indinavir, and digoxin (Johns *et al.*, 1999; Cheng, 2000; Piscitelli *et al.*, 2000) and Tamarind (*Tamarindus indica*) increases the bioavailability of acetylsalicylic acid (Mustapha *et al.*, 1999). The documentation of herb-drug reactions in people with overweight or obesity has not been reported in Mexico. The main objective of this work was to assess the prevalence of concomitant use of HPWL and allopathic medicine. This study also describes suspected adverse reactions associated with

the consumption of HPWL, and adverse reactions reported in the concomitant use of HPWL and allopathic medicine. The effect of HPWL on medication adherence is also reported.

## MATERIALS AND METHODS

### Study design

The study was descriptive, retrospective, and cross-sectional using a questionnaire, carried out from June 2019 to January 2020 by overweight (BMI: 25-30 kg/m<sup>2</sup>) and obese (BMI: >30 kg/m<sup>2</sup>) participants attending public and private hospitals from five cities in four states of Central Mexico: Guadalajara (state of Jalisco), San Luis Potosí (state of San Luis Potosí), Guanajuato and León (state of Guanajuato), and Puebla (state of Puebla). The recruitment of participants, attending hospitals for routine physical exams and control-weight programs, was done by the researchers with the support of hospital staff. The population in these five cities is approximately 5.1 million people. Among these cities, Guadalajara, Puebla, and León are the third, fourth, and seventh, respectively, most populated cities in Mexico (INEGI, 2015). The validity of this survey was evaluated with the assistance of two highly qualified co-workers in the scientific area. The survey assessed: a) socio-demography (age, marital status, gender, employment, educational level, weight, and height, etc.), b) socio-economy (number of rooms, number of bathrooms, numbers of occupants and relationship to interviewee, etc.) calculated according to the Mexican Association of Market and Public Opinion Research Agencies (AMAI, 2018), c) use of HPWL, d) comorbidity, and e) concurrent use of HPWL and allopathic medicine. The anonymity of respondents was maintained.

The appropriate population size for this study was estimated using the Raosoft software (Raosoft, Inc. free online software, Seattle, WA, USA). The population residing in these 5 cities included approximately 5.1 million people estimating that approximately 75% of the Mexican population is overweight and obese (ENSANUT, 2018). The sample population considered 3.8 million residents, the margin of error was 5%, the confidence level was 99%, and the response distribution was 50%, and thus, a sample size of 662 was necessary. All respondents were enrolled in the study. The inclusion criteria were as follows: general population with overweight or obesity attending a public or private hospital, capable of signing an informed consent, consuming HPWL, and older than 18 years old. Body

mass index was calculated using the body weight and height of each participant. The aim of this work was described to the interviewed respondents. Every interviewer received specialized training before carrying out the survey. The duration of each survey was 5 min. The protocol of this study was approved by the Research Ethics Committee (number 21608) of the Mexican Institute of Social Security, IMSS (protocol number CEI 2017082).

### **Plant identification**

Participants and the herb companies gave a brief taxonomical description of the medicinal plant. In some cases, the herb companies provided herbal samples for the taxonomic identification. Samples of plant species were obtained from different regions in Mexico, preserved, and identified in the herbarium Isidro Palacios (SLPM), Universidad Autónoma de San Luis Potosí, Mexico [Autonomous University of San Luis Potosí, Mexico] and the National Herbarium of Mexico (MEXU), National Autonomous University of Mexico. The scientific names of the plant species were corroborated in the Missouri Botanical Garden database.

### **Data analysis**

Adherence to medications was measured using the Morisky Medication Adherence Scale, which consists of 4 yes/no questions about medication use patterns (Morisky *et al.*, 1986). The Naranjo scale was used to determine the probability of an observed adverse event in the use of HPWL (Naranjo *et al.*, 1981). The Horn algorithm was used to determine that an interaction between allopathic medicine and HPWL was causing an adverse event with the following considerations: herbal products were considered as the precipitant drug, whereas allopathic medicine as the object drug (Horn *et al.*, 2007). Interactions between allopathic medicine and herbal products were documented according to Micromedex database (DRUG-REAX, 2009) and the Stockley book (Stockley, 2002).

All responses were considered with a congruent temporal relationship between the adverse effect and the use of precipitating drugs. Other alternative causes were considered as herbal products without knowing their components and quantity. Signs and symptoms referred by the respondents were taken as an objective evidence of the relationship between the adverse effect and the precipitant drug. The evaluations were carried out by two independent researchers, who discussed each

case to obtain an agreement. The findings are presented as the means (standard deviations), percentages and odd ratios (95% CI), when specified. A chi-square test examined associations between socio-demographic and socio-economic information, and the concomitant use of HPWL and allopathic medicine. Statistical examination was executed using the software SPSS v20 (SPSS Inc, Chicago, IL). Statistical significance was set as  $p < 0.05$ .

### **RESULTS**

Most respondents were women (72%), with an average age of  $40.76 \pm 13.75$  years, married/cohabitant (60.9%), overweight (49.5%), and with middle-socioeconomic status (65.3%) (Table No. 1). Besides, 31.7% and 21.6% of the respondents indicated to be diagnosed with diabetes and hypertension, respectively. Findings showed that 45.2% of the respondents combine HPWL and prescribed allopathic medicine (Table No. 1). Most of these drugs correspond to antidiabetic drugs (32.8%), anti-hypertensive drugs (21.6%), and drugs for weight loss (4.7%, orlistat).

Age, marital status (married/cohabitant), obesity grade I, and educational level (high school, and college/postgraduate) were the factors associated ( $p < 0.05$ ) with the concomitant use of HPWL and allopathic medicine (Table No. 1). Among these factors, respondents older than 50 years [OR: 11.056 (6.586 - 18.561)], respondents among 30 and 49 years old [OR: 2.307 (1.552 - 3.429)], and obesity grades II and III [OR: 1.908 (1.124 - 3.240)] were the strongest factors associated with the concomitant use of HPWL and allopathic medicine (Table No. 1). The prevalence of ARs in respondents with concomitant use HPWL and allopathic medicine was 25.3% (Table No. 1).

Respondents ( $n=299$ ) using prescribed medicine in combination with HPWL, showed an adherence of 33.1%. Findings showed that 53.7% of the respondents do not take their medications at the indicated time, 47.1% forgot to take, at least once, their medication, 30.9% stopped taking their medications when an improvement in health status was perceived, and 24.8% stopped taking their medications when a breakdown of health status was detected. The only factors associated with the alteration of medication adherence by the consumption of HPWL were high socioeconomic status [OR: 1.795 (1.012 - 3.183)] and the use of antidiabetic drugs [OR: 1.734 (1.113 - 2.703)] (results not shown).

**Table No. 1**  
**Factors associated with the concomitant use of HPWL and allopathic medicine**

Characteristic	TOTAL N=662	Concomitant use with allopathic medicine Frequency [n (%)]			OR (95% CI)
		YES N=299 (45.2)	NO n=363 (54.8)	<i>p</i>	
<b>Gender</b>					
Female	476 (71.9)	258 (71.1)	218 (72.8)	0.601	0.913 (0.649 – 1.284)
Male	186 (28.1)	105 (28.9)	81 (27.1)		
<b>Age, years</b>	40.76 ± 13.75	45.65 ± 13.64	34.82 ± 11.34	< 0.001	-
18 – 29	163 (24.6)	51 (14)	112 (37.5)	1	Ref.
30 – 49	324 (48.9)	166 (45.7)	158 (52.8)	< 0.001	2.307 (1.552 – 3.429)
> 50	175 (26.4)	146 (40.2)	29 (9.7)	< 0.001	11.056 (6.586 – 18.561)
<b>Marital status</b>					
Married/cohabitant	403 (60.9)	245 (67.5)	158 (52.8)	< 0.001	1.853 (1.351 -2.541)
Single/divorced/widow	259 (39.1)	118 (32.5)	141 (47.2)		
<b>Body mass index</b>	30.50 ± 3.59	30.85 ± 3.46	30.08 ± 3.71	0.006	-
Overweight	328 (49.5)	156 (43)	172 (57.5)	1	Ref.
Obesity I	263 (39.7)	162 (44.6)	101 (33.8)	0.001	1.768 (1.272 – 2.459)
Obesity II and III	71 (10.8)	45 (12.4)	26 (8.7)	0.016	1.908 (1.124 – 3.240)
<b>Education</b>					
Elementary and middle school	223 (33.7)	150 (41.3)	73 (24.4)	1	Ref.
High school	209 (31.6)	100 (27.5)	109 (36.5)	<0.001	0.444 (0.300 – 0.655)
College-postgraduate	230 (34.7)	113 (31.1)	117 (39.1)	<0.001	0.463 (0.316 – 0.677)
<b>Socioeconomic status</b>					
High	83 (12.5)	79 (21.8)	68 (22.7)	1	Ref.
Middle	423 (65.3)	230 (63.4)	202 (67.6)	0.916	0.980 (0.673 – 1.426)
Low	147 (22.2)	54 (14.9)	29 (9.7)	0.067	1.684 (0.963 – 2.946)
<b>Use of HPWL</b>					
Only one product	538 (81.3)	299 (82.4)	239 (79.9)	0.242	1.173 (0.793 – 1.734)
2 or more products	124 (18.7)	64 (17.6)	60 (20.1)		
Adverse reactions	174 (26.3)	92 (25.3)	82 (27.4)	0.545	1.113 (0.787 – 1.575)

Values are expressed as the mean + SD (quantitative variables) and n (%) qualitative variables.  
SD = standard deviation

Age was significantly ( $p < 0.05$ ) associated with the presence of ARs during the concomitant use of HPWL and allopathic medicine (Table No. 2). The strongest factors associated with the presence of ARs in respondents that use HPWL and allopathic

medicine were age (older than 50 years) [OR:15.708 (5.406 - 45.648)], respondents among 30 and 49 years old [OR: 3.151 (1.339 - 7.412), and obesity grades II and III [OR: 3.013 (1.272 - 2.459)] (Table No. 2). When respondents use only HPWL, ARs are

classified as *possible* in 95.1% of the cases, whereas in the concomitant use of HPWL and allopathic medicine the ARs are classified as *probable* in 59.8% of the cases (Table No. 2). The findings showed that ARs classified as *possible* are 4 times more likely to be presented in respondents that concomitant use HPWL and allopathic medicine [OR: 4.255 (1.101 - 16.435)], than respondents that use only HPWL. ARs

classified as *doubtful* are 40 times more likely to be presented [OR: 39.709 (5.245 - 300.627)] in respondents that concomitant use HPWL and HM (Table No. 2) A total of 203 ARs in 174 respondents were recorded (Table No. 3). Eighty-two of these ARs were due to the use of HPWL and 92 ARs were reported for the concomitant use of HPWL and allopathic medicine (Table No. 2).

Table No. 2

Factors associated with the presence of the total adverse reactions (n=194 respondents) and the use of HPWL

Characteristic	Concomitant use with allopathic medicine [n (%)]			OR (95% CI)
	YES* N=92 (25.3)	NO** n=82 (26.3)	p	
<b>Gender</b>				
Female	72 (78.3)	58 (70.7)	0.254	1.490 (0.750 – 2.961)
Male	20 (21.7)	24 (29.3)		
<b>Age, years</b>	45.97 + 11.26	35.50 + 12.03	< 0.001	-
18 – 29	9 (9.8)	29 (35.4)	1	Ref.
30 – 49	44 (47.8)	45 (54.9)	0.007	3.151 (1.339 – 7.412)
> 50	39 (42.4)	8 (9.8)	< 0.001	15.708 (5.406 – 45.648)
<b>Marital status</b>				
Married/cohabitant	64 (69.6)	44 (53.7)	0.031	1.974 (1.061 -3.673)
Single/divorced/widow	28 (30.4)	38 (46.3)		
<b>Body mass index</b>	31.25 + 3.81	29.99 + 3.35	0.023	-
Overweight	39 (42.4)	47 (57.3)	1	Ref.
Obesity I	38 (41.3)	29 (25.4)	0.109	1.579 (0.830 – 3.005)
Obesity II and III	15 (16.6)	6 (7.3)	0.032	3.013 (1.067 – 8.503)
<b>Educational level</b>				
Elementary and middle school	41 (44.6)	24 (29.3)	0.034	2.187 (1.058 – 4.521)
High school	26 (28.3)	26 (31.7)	0.155	1.708 (0.814 – 3.585)
College-postgraduate	25 (27.2)	32 (39)	1	Ref.
<b>Socioeconomic status</b>				
High	21 (22.8)	16 (19.5)	1	Ref.
Middle	59 (64.1)	60 (73.2)	0.446	0.749 (0.356 – 1.575)
Low	12 (13)	6 (7.3)	0.481	1.524 (0.470 – 4.940)
<b>Use of HPWL</b>				
Only one product	69 (75)	63 (76.8)	0.778	0.905 (0.451 – 1.817)
2 or more products	23 (25)	19 (23.2)		
<b>Causality of adverse reactions</b>				
Doubtful	28 (30.4)	1 (1.2)	< 0.001	39.709 (5.245 – 300.627)
Possible	55 (59.8)	78 (95.1)	1	Ref.
Probable	9 (9.8)	3 (3.7)	0.025	4.255 (1.101 – 16.435)
Definitive	0	0		

Values are expressed as the mean + SD (quantitative variables) and n (%) qualitative variables.

SD = standard deviation. HPWL = herbal products for weight loss

\* Denotes evaluation of causality using Naranjo algorithm

\*\* Denotes evaluation of causality using Horn algorithm

A total of 12 plant species were taxonomically identified (Table No. 3). It was not possible to identify other medicinal plants due the lack of botanical information provided by the respondents. The most common herbs used cited were in the following order: Green tea [*Camellia sinensis* (L.) Kuntze (Theaceae)], soybean [*Glycine max* (L.) Merr. (Fabaceae)], aloe [*Aloe vera* (L.) Burm. f. (Asphodelaceae)], artichoke [*Cynara scolymus* L. (Asteraceae)], Brazil nut [*Bertholletia excelsa* Bonpl. (Lecythidaceae)], aceitilla [*Bidens odorata* Cav (Asteraceae)], moringa [*Moringa oleifera* Lam. (Moringaceae)], guarana [*Paullinia cupana* Kunth (Sapindaceae)], ginger [*Zingiber officinale* Rosco (Zingiberaceae)], coffee [*Coffea arabica* L. (Rubiaceae)], linseed [*Linum schiedeanum* Schltdl. & Cham (Linaceae)], and Mexican hawthorn [*Crataegus mexicana* Moc. & Sessé ex DC

(Rosaceae)]. The HPLW with most ARs reported were coffee (36.4%), moringa (34.8%), aloe (34.8%), and green tea (29%). Green tea was the most frequent (33%) plant included in HPWL (Table No. 3). The most frequent ARs in the consumption of the concomitant use of HPWL and allopathic medicine were vomiting/nausea, headache, stomachache, and fatigue (Table No. 3). These ARs were classified as *possible*, whereas one (vomiting/nausea) ARs for green tea and one AR (vomiting/nausea) for artichoke were classified as *probable*.

The most frequent combinations that induce ARs were Aloe-metformin (10.1%), followed by green tea-metformin (9.2%), green tea-insulin (8.3%), and artichoke-metformin (4.6%). The most frequent ARs among these combinations were nausea/vomiting (21.1%), headache (13.8%), stomachache (11%), and diarrhea (11%).

**Table No. 3A**  
**Frequency of use among herbs contained in products for weight loss and reports of AR**

Medicinal plants contained in HPWL	Green tea	Guarana	Aceitilla	Artichoke	Soybean	Aloe
<b>Frequency of use of HPWL alone and in combination with allopathic medicine</b>						
Use reports of herbal products	N=856 (%)	n=283 (%)	n=23 (%)	n=25 (%)	n=67 (%)	n=104 (%)
Reports of AR	203 (23.72)	82 (29)	4 (17.4)	4 (16)	17 (25.4)	26 (25)
<b>Distribution of concomitant use of HPWL without allopathic medicine</b>						
Reports of AR	n=73 (%)	n=23 (%)	n=1 (%)	0	n=10 (%)	n=13 (%)
Vomiting/Nausea	17 (23.3)	7 (30.4)*			2 (20)**	4 (30.8)
Stomachache	6 (8.2)	2 (8.7)			1 (10)	1 (7.7)
Diarrhea	5 (6.9)	1 (4.4)			1 (10)	0
Headache	14 (19.2)	3 (13)			2 (20)	6 (46.2)
Fatigue	6 (8.2)	1 (4.4)			3 (30)	1 (7.7) [0/1]
Kidney problems	2 (2.7)	1 (4.4)				
Hypoglycemia	2 (2.7)					
unspecific	21 (27.8)	8 (34.8)	1 (100)		1 (10)	1 (7.7)
						3 (50)

Causality was evaluated with the algorithm of Naranjo in AR reports in patients using only HPWL resulting in possible cases. \* Denotes AR classified as probable (1/5). \*\* Denotes AR classified as probable (1/2).

HPWL= herbal products for weight loss

**Table No. 3B**  
**Frequency of use among herbs contained in products for weight loss and reports of AR**

Medicinal plants contained in HPWL	Brazil nut	Ginger	Moringa	Linseed	Coffee	Mexican hawthorn	Others
<b>Frequency of use of HPWL alone and in combination with allopathic medicine</b>							
Use reports of herbal products	N=856 (%)	n=49 (%)	n=22 (%)	n=23 (%)	n=10 (%)	n=11 (%)	n=10 (%)
Reports of AR	203 (23.72)	11 (22.5)	4 (18.2)	8 (34.8)	3 (30)	4 (36.4)	2 (20)
<b>Distribution of concomitant use of HPWL without allopathic medicine</b>							
Reports of AR	n=73 (%)	n=6 (%)	0	n=1 (%)	n=1 (%)	0	0
Vomiting/Nausea	17 (23.3)						3 (23.08)
Stomachache	6 (8.2)	2 (33.3)					0
Diarrhea	5 (6.9)						1 (7.7)
Headache	14 (19.2)	1 (16.7)					2 (15.4)
Fatigue	6 (8.2)						2 (15.4)
Kidney problems	2 (2.7)	1 (16.7)					0
Hypoglycemia	2 (2.7)	1 (16.7)			1 (100)		0
unspecific	21 (27.8)	1 (16.7)		1 (100)			5 (38.5)

**Causality was evaluated with the algorithm of Naranjo in AR reports in patients using only HPWL resulting in possible cases. \* Denotes AR classified as probable (1/5). \*\* Denotes AR classified as probable (1/2).**

**HPWL= herbal products for weight loss**

Table No. 4 shows the causality determinants for ARs classified as *probable*, which result from the concomitant use of HPWL and allopathic medicine. The documentation of the interaction among HPWL and allopathic medicine, suspension, and re-administration is also reported. It is interesting to note that two ARs have not been previously documented. Green tea and metformin induce dizziness and irritability.

## DISCUSSION

The findings showed that 45.2% of the respondents combine HPWL and prescribed allopathic medicine. The prevalence of concomitant use of herbs and allopathic medicine ranges from 22-30% (Clement *et al.*, 2007; Olisa & Oyelola, 2009; Picking *et al.*,

2011; Liwa *et al.*, 2017). The prevalence found in this study is higher than other studies.

Age (older than 50 years old) was the strongest factor for the concomitant use of HPWL and allopathic medicine. Other studies have shown that age is an important factor for combining allopathic medicine and herbs without consulting a physician (Olisa & Oyelola, 2009). Some reasons for combining drug and herbs are the perceived failure of allopathic medicine, the adverse effect of pharmaceuticals, unavailability of allopathic medicine, perception of effectiveness in the mixture, and the high cost of allopathic medicine (Clement *et al.*, 2007; Olisa & Oyelola, 2009; Picking *et al.*, 2011).

**Table No. 4**  
**Description of causality assessment classified as probable among the combinations of HPWL and allopathic medicine**

Medicinal plant	Drugs	AR	Evaluation of causality (score)	Determinants of causality
Green tea	Metformin	Dizziness	Probable (6)	Interaction = No documented Discontinuing treatment = elimination of the discomfort Re-administration = return of the of the discomfort
Aloe	Glibenclamide	Irritability	Probable (6)	Interaction = documented Discontinuing treatment = elimination of the discomfort Re-administration = no return of the discomfort
Aloe	Metformin	Backache	Probable (6)	Interaction = documented Discontinuing treatment = elimination of the discomfort Re-administration = return of the discomfort
Green tea	Enalapril	Headache	Probable (6)	Interaction = documented Discontinuing treatment = discomfort continues No Re-administration
Coffee	Enalapril	Headache	Probable (6)	Interaction = documented Discontinuing treatment = discomfort continues No Re-administration
Green tea	Metformin	Irritability	Probable (6)	Interaction = No documented Discontinuing treatment = elimination of the discomfort Re-administration = return of the discomfort
Multiformula (green tea, guarana, aloe, soybean)	Telmisartan	Fluid retention	Probable (6)	Interaction = documented Discontinuing treatment = elimination of the discomfort No Re-administration
Green tea	Losartan	Dolor abdominal	Probable (5)	NO Interaction = documented Discontinuing treatment = elimination of the discomfort Re-administration = return of the discomfort
Unspecific data	Losartan	Diarrhea	Probable (5)	Interaction = unknown Discontinuing treatment = elimination of the discomfort Re-administration = return of the discomfort

The findings showed a medication adherence of 33.1%, which was influenced using HPWL. Studies in Honduras and Tanzania showed a medication adherence of 75% and 60%, respectively, in patients consuming herbs for primary health care and hypertensive drugs, respectively (Catalino *et al.*, 2015; Liwa *et al.*, 2017). The study in Tanzania found no factors associated with non-adherence

(Liwa *et al.*, 2017). On the other hand, the study in Honduras found that a traditional massage therapy decreased the medication adherence (Catalino *et al.*, 2015). This study indicates that medication adherence is decreased by the consumption of HPWL, associated with a high economic status.

The prevalence of ARs in respondents that concomitant use HPWL and allopathic medicine was

25.3%. A study in Trinidad reported that 6% of respondents reported ARs associated with the use of medicinal herbs for primary health care, whereas 3.7% of patients that combine herbs and allopathic medicine experienced AR. The main ARs were diarrhea and hypotension (Clement *et al.*, 2007). A study in Jamaica reported no ARs when patients combine allopathic medicine and herbs for primary health care (Picking *et al.*, 2011). A study in Nigeria found that 21% of hypertensive patients reported ARs when combining allopathic medicine and anti-hypertensive drugs (Olisa & Oyelola, 2009).

The main ARs found in this study were related to the gastrointestinal system. Similarly, Clement *et al.* (2007), reported that the main ARs, produced by combining herbs and allopathic medicine in Trinidad were diarrhea and hypotension. The main ARs found with the concomitant use of drug and herbs for weight loss in Italy were related to the cardiovascular system, followed by hepatic, and central nervous system (Mazzanti *et al.*, 2019).

This study highlights the following perspectives: a) the search for contaminants (pathogens), adulterants, and undeclared drugs is also a possible option for adverse reactions found in this study. A recent study in Italy found the presence of mephedrone, cathinone, norephedrine, synephrine, and 1,3-dimethylamylamine in HPWL (Mazzanti *et al.*, 2019); b) the analysis of possible pharmacodynamic and pharmacokinetic interactions among drug-herb interactions reported in this study. There are scarce studies regarding how plant extracts are metabolized by human CYP450 enzymes; c) the toxicity of many medicinal plants remains to be studied.

This study suggests that a phyto-vigilance system should be implemented in Mexico. AR monitorization of drug-herb concomitant use is of great importance. In addition, patients should also ask their physicians before making the decision of consuming herbal products. In addition, physicians should advise patients about the risk of consuming herbs.

### **Limitations**

Some limitations of this study include the following: a) demographics since no rural areas were considered

and only the central region of the country was studied. The results are not representative of the entire population, and the sample consisted mainly of women. Future studies will need to cover more diverse geographical areas. b) causality: incomplete information was found in some cases, to evaluate causality assessment, and herbal products containing different metabolites. Therefore, the causality is attributed to a mixture of several components. However, causality assessment scales do not consider a mixture of components. c) There is a high possibility of undeclared medicinal herbs on the product label.

### **CONCLUSIONS**

There is a high prevalence (45.2%) of the concomitant use of herbal products for weight loss and allopathic medicine in people with overweight or obesity in Central Mexico, associated mainly by age (older than 50 years) [OR:15.708 (5.406 - 45.648)]. The prevalence of ARs in respondents with concomitant use HPWL and allopathic medicine was 25.3%. These ARs were mainly gastrointestinal (43% of the cases). The concomitant use of HPWL induces low (33%) medication adherence.

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### **REFERENCES**

Alonso-Castro AJ, Domínguez F, Maldonado-Miranda JJ, Castillo-Pérez LJ, Carranza-Álvarez C, Solano E, Isiordia-Espinoza MA, Juárez-Vázquez MC, Zapata-Morales JR, Argueta-Fuertes MA, Ruiz-Padilla AJ, Solorio-Alvarado CR, Rangel-Velázquez JE, Ortiz-Andrade R, González-Sánchez I, Cruz-Jiménez G, Orozco-Castellanos LM. 2017. Use of medicinal plants by health professionals in Mexico. *J*

- Ethnopharmacol** 198: 81 - 86. <https://doi.org/10.1016/j.jep.2016.12.038>
- Alonso-Castro AJ, Ruiz-Padilla AJ, Ramírez-Morales MA, Alcocer-García SG, Ruiz-Noa Y, Ibarra-Reynoso LR, Solorio-Alvarado CR, Zapata-Morales JR, Mendoza-Macías CL, Deveze-Álvarez MA, Alba-Betancourt C. 2019. Self-treatment with herbal products for weight-loss among overweight and obese subjects from central Mexico. **J Ethnopharmacol**. 234: 21 - 26. <https://doi.org/10.1016/j.jep.2019.01.003>
- AMAI. 2018. (Asociación mexicana de agencias de inteligencia de mercado y opinión) (Mexican Association of Market Intelligence). <http://nse.amai.org/wp-content/uploads/2018/04/Cuestionario-NSE-2018.pdf>
- Catalino MP, Durón RM, Bailey JN, Holden KR. 2015. The influence of traditional and complementary and alternative medicine on medication adherence in Honduras. **Altern Ther Health Med** 21: 26 - 35.
- Clement YN, Morton-Gittens J, Basdeo L, Blades A, Francis MJ, Gomes N, Janjua M, Singh A. 2007. Perceived efficacy of herbal remedies by users accessing primary healthcare in Trinidad. **BMC Complement Alt Med** 7: 4.
- Cheng TO. 2000. St. John's wort interaction with digoxin. **Arch Int Med** 160: 25 - 48. <https://doi.org/10.1001/archinte.160.16.2548>
- DRUG-REAX System [internet database]. 2009. Greenwood Village, CO: Thomson Reuters (Healthcare).
- Encuesta Nacional de Salud y Nutrición [National Health and Nutrition Survey] (ENSANUT). 2020. [https://www.inegi.org.mx/contenidos/programas/ensanut/2018/doc/ensanut\\_2018\\_presentacion\\_resultados.pdf](https://www.inegi.org.mx/contenidos/programas/ensanut/2018/doc/ensanut_2018_presentacion_resultados.pdf)
- Horn JR, Hansten PD, Chan LN. 2007. Proposal for new tool to evaluate drug interaction cases. **Ann Pharmacother** 41: 674 - 680. <https://doi.org/10.1345/aph.1H423>
- Instituto Nacional de Estadística Geografía e Informática. (INEGI) 2015. <http://cuentame.inegi.org.mx/poblacion/habitantes.aspx?tema=P>
- John A, Brockmüller J, Bauer S, Maurer A, Langheinrich M, Roots I. 1999. Pharmacokinetic interaction of digoxin with an herbal extract from St John's wort (*Hypericum perforatum*). **Clin Pharmacol Ther** 66: 338 - 345. <https://doi.org/10.1053/cp.1999.v66.a101944>
- Liwa A, Roediger R, Jaka H, Bougaila A, Smart L, Langwick S, Peck R. 2017. Herbal and alternative medicine use in Tanzanian adults admitted with hypertension-related diseases: A mixed-methods study. **Int J Hypertens** article 5692572. <https://doi.org/10.1155/2017/5692572>
- Mazzanti G, Vitalone A, Da Cas R, Menniti-Ippolito F. 2019. Suspected adverse reactions associated with herbal products used for weight loss: spontaneous reports from the Italian phytovigilance system. **Eur J Clin Pharmacol** 75: 1599 - 1615. <https://doi.org/10.1007/s00228-019-02746-6>
- Morisky DE, Green LW, Levine DM. 1986. Concurrent and predictive validity of a self-reported measure of medication adherence. **Medical Care** 24: 67 - 74. <https://doi.org/10.1097/00005650-198601000-00007>
- Mustapha A, Yakasai IA, Aguye IA. 1996. Effect of *Tamarindus indica* L. on the bioavailability of aspirin in healthy human volunteers. **Eur J Drug Metab Pharmacokinet** 21: 223 - 226. <https://doi.org/10.1007/BF03189717>
- Naranjo CA, Busto U, Sellers EM, Sandor P, Ruiz I, Roberts EA, Janecek E, Domecq C, Greenblatt DJ. 1981. A method for estimating the probability of adverse drug reactions. **Clin Pharmacol Ther** 30: 239 - 345. <https://doi.org/10.1038/clpt.1981.154>
- Olisa NS, Oyelola FT. 2009. Evaluation of use of herbal medicines among ambulatory hypertensive patients attending a secondary health care facility in Nigeria. **Int J Pharm Pract** 17: 101 - 105. <https://doi.org/10.1211/ijpp.17.02.0005>
- Picking D, Younger N, Mitchell S, Delgoda R. 2011. The prevalence of herbal medicine home use and concomitant use with pharmaceutical medicines in Jamaica. **J Ethnopharmacol** 137: 305 - 311. <https://doi.org/10.1016/j.jep.2011.05.025>
- Piscitelli SC, Burstein AH, Chait D, Alfaro RM, Falloon J. 2000. Indinavir concentrations and St John's wort. **The Lancet** 355: 547 - 548. [https://doi.org/10.1016/S0140-6736\(99\)05712-8](https://doi.org/10.1016/S0140-6736(99)05712-8)
- Ríos-Hoyo A, Gutiérrez-Salmeán G. 2016. New dietary supplements for obesity: What we currently know. **Curr Obes Rep** 5: 262 - 270. <https://doi.org/10.1007/s13679-016-0214-y>
- Stockley IH. 2002. **Stockley's drug interactions**. The Pharmaceutical Press, London, UK.
- WHO. 2018. (World Health Organization). <https://www.who.int/topics/obesity/en>