



**Notre Dame University**

**Faculty of Nursing and Health Sciences**

**Weight Loss Supplements in the Lebanese Market: Safety, Efficacy and Use.**

**Thesis presented by Suzanne Bteich**

**For the fulfillment of the degree of Masters in Human Nutrition**

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## Approval Certificate


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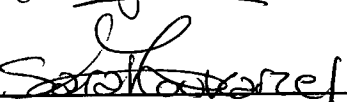
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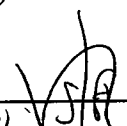
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## TABLE OF CONTENTS

<b>ABSTRACT .....</b>	<b>1</b>
<b>BACKGROUND.....</b>	<b>1</b>
<b>Introduction .....</b>	<b>1</b>
<b>Management of obesity .....</b>	<b>2</b>
<b>Weight loss supplements use .....</b>	<b>3</b>
<b>Regulation of Weight-Loss Supplements .....</b>	<b>5</b>
<b>Ingredients in Weight-Loss Supplements .....</b>	<b>7</b>
<b>Reasons for skepticism and possible dangers .....</b>	<b>7</b>
<b>Lack of evidence of efficacy.....</b>	<b>7</b>
<b>Lack of safety.....</b>	<b>9</b>
<b>Counterfeit pills.....</b>	<b>11</b>
<b>STUDY OBJECTIVES.....</b>	<b>12</b>
<b>Primary objectives .....</b>	<b>12</b>
<b>Secondary objectives.....</b>	<b>12</b>
<b>MATERIALS AND METHODS.....</b>	<b>12</b>
<b>General study design and population.....</b>	<b>12</b>
<b>Target population.....</b>	<b>12</b>
<b>Inclusion/exclusion criteria .....</b>	<b>12</b>
<b>Procedure.....</b>	<b>13</b>
<b>Study instruments .....</b>	<b>13</b>
<b>Data Analysis .....</b>	<b>16</b>

<b>RESULTS.....</b>	<b>16</b>
Descriptive analysis.....	16
<b>DISCUSSION .....</b>	<b>19</b>
<b>CONCLUSION.....</b>	<b>24</b>
<b>STRENGTHS AND LIMITATIONS .....</b>	<b>25</b>
<b>REFERENCES .....</b>	<b>27</b>
<b>APPENDICES .....</b>	<b>38</b>
Informed consent.....	38
Interview questions .....	39
<b>TABLES .....</b>	<b>44</b>
Table 1: Drugs approved as adjuncts to diet and exercise for treatment of obesity.....	44
Table 2: Ingredients of weight-loss supplements .....	45
Table 3: Weight loss products available on the Lebanese market .....	49
Table 4: Distribution of participants by their sociodemographic data ( <i>n</i> =200).....	60
Table 5: Health determinants of participants ( <i>n</i> =200) .....	61
Table 6: Weight loss methods and attempts of participants .....	62
Table 7: Users of weight loss supplements ( <i>n</i> =100).....	63
Table 8: Users and non-users beliefs about weight and weight loss supplements.....	65

## ABSTRACT

**Background:** Increasing prevalence of overweight and obesity is a major worldwide problem associated with many metabolic abnormalities. Compliance is poor with lifestyle modifications required for losing weight and maintaining long-term weight loss. There are no highly efficacious and safe therapeutic drugs for weight-loss, and few medications are approved for long-term management of obesity. In recent years, the use of supplements for weight loss has steadily increased among US and European adults. Weight loss supplements are easily available without prescriptions and do not require strict regulations before being marketed with a misconception that they are innocuous. Because most supplements promote fast decrease in weight that results in the loss of muscle water and lean body mass, they may interact with medications, may be associated with life-threatening adverse reactions and abuse, they may be adulterated with drugs, have inappropriate formulations and they lack evidence of efficacy and safety, they create a potential risk to consumers. Little is known about their current use in Lebanon.

**Objectives:** The objectives of this study are to identify supplements and drugs for weight loss in the Lebanese market; explore the knowledge and behaviors toward weight loss supplements; and to assess socioeconomic, health and lifestyle characteristics related to their use. **Method:** A total of 200 subjects recruited from a pharmacy in Mount Lebanon were interviewed. To evaluate the baseline cross-sectional relationship between two groups, users of weight loss supplements were considered the cases and subjects who never used them as controls. **Results:** Users of weight loss supplements were more likely to be female, aged 45 years or older, married, unemployed, with lower level of education, excess

weight, smokers and to have hypothyroidism and positive SCOFF. Also they were more likely to have attempted to lose weight more than 4 times, to have followed a specific diet and to have used orlistat. Pharmacies were the most common source for obtaining weight loss supplements. Most users reported experiencing side effects. **Conclusion:** Extensive range of products for weight loss were identified. They are consumed extensively and without medical supervision and pose potential risks to consumers. Increased awareness should be provided to overweight and obese individuals about evidence-based weight loss strategies.

*Keywords: Obesity, weight loss supplements, safety*

## BACKGROUND

### Introduction

Increasing prevalence of overweight and obesity is a major worldwide problem associated with many health risks and metabolic abnormalities including increased blood cholesterol, triglycerides and glucose levels, insulin resistance, metabolic syndrome, and hypertension (Blüher, 2013). In a large meta-analysis of 230 cohort studies including over 30 million individuals, both obesity and overweight were associated with an increased risk of all-cause mortality (Aune et al., 2016). Prevalence estimates are based on the body mass index (BMI), defined as the weight in kilograms divided by height in meters squared. Overweight is defined as a BMI of 25 to 29.9 kg/m<sup>2</sup>, obesity is defined as a BMI of  $\geq 30$  kg/m<sup>2</sup>, and severe obesity is defined as a BMI  $\geq 40$  kg/m<sup>2</sup> or  $\geq 35$  kg/m<sup>2</sup> in the presence of comorbidities (Pasco et al., 2014). In the United States, in a 2013 to 2014 report, the prevalence of obesity in men was stable at approximately 35 percent but increased in women to 40.4 percent (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016).

In developing countries, obesity prevalence ranges from 2.3 to 12 %, and overweight is 28.8 %, mostly affecting females (Poobalan & Aucott, 2016). Prevalence of obesity is also increasing in Lebanon. A national survey conducted by Chamieh MC et al (2015) estimated the prevalence of obesity in Lebanese adults to be 26.1%, while Mallat et al (2016) reported that 52.77% of Lebanese adults were overweight and obese (n=593).

Nasreddine et al (2012) studied secular trends in obesity prevalence over a twelve-year period in Lebanon. A significant increase in obesity prevalence in Lebanese population

was observed (3.6% in children and adolescents; 10.8% in adults) while the prevalence of overweight appeared stable over the study period in both groups. This alarming increase in obesity prevalence is mainly attributed to the accelerated rate of modernization, lifestyle changes such as an accelerated pace of nutrition transition, and sedentary behavior. Salameh P. et al (2014) assessed dietary intake patterns in a cross sectional study among university students in Lebanon ( $n=3384$ ). The results showed that male students were more prone to adopt a westernized diet known to be high in calories and saturated and *trans* fat, and a strong avoidance of plant food and composite dishes, while females were more prone to follow vegetarian/low calorie diets.

### **Management of obesity**

The optimal management of obesity requires a combination of diet, exercise, and behavioral modification. In addition, some patients eventually require pharmacologic therapy or bariatric surgery. The goal of therapy is to prevent, reverse, or ameliorate the complications of obesity and improve quality of life. Restricting caloric intake and engaging in physical activity are the lifestyle modifications required for losing weight and maintaining long-term weight loss (Jensen et al., 2014).

There are no highly efficacious and safe therapeutic drugs for weight-loss, and few medications are approved by the US Food and Drug Administration (FDA) for long-term management of obesity. In individuals with a BMI  $\geq 30$  kg/m<sup>2</sup> or those with a BMI  $\geq 27$  and at least one obesity-related comorbidity, pharmacotherapy can be considered as an adjunct to achieve the target of at least 5% weight loss and consequent health benefits, as set by the US Food and Drug Administration (FDA) guidelines (Jensen et al., 2014).

Orlistat has the approval for use in adolescents and adults, and lorcaserin, phentermine-extended release topiramate, naltrexone-bupropion, and liraglutide are approved for use in adults only (Kakkar & Dahiya, 2015; Khera et al., 2016; Rodríguez & Campbell, 2016). **Table 1** summarizes drugs approved for the treatment of obesity.

### **Weight loss supplements use**

In the beginning of the 2000s, prevalence of adults attempting weight loss has peaked due to changes in social norms regarding obesity, an increase in products and services targeting weight management or greater importance attributed by the population to weight or body shape and health (Santos, Sniehotta, Marques, Carraça, & Teixeira, 2017). Attempts to lose weight are also common among Lebanese adults, however compliance with conventional weight loss programs is poor and individuals try to engage in unhealthy weight control behaviors without professional assistance (Tamim et al. 2006). Unhealthy weight loss practices are frequently pursued mainly by women (Machado, Silveira, & Silveira, Vera Maria Freitas da, 2012; Sharpe, Blanck, Williams, Ainsworth, & Conway, 2007). Of the different methods to lose weight, women are less likely than men to use physical activity, and they tend to seek easier alternatives to achieve their target. They use herbs and teas, home remedies, massage and over-the-counter weight loss supplements which, by their attractive packaging and claims promise rapid weight loss (Austin, Yu, Liu, Dong, & Tefft, 2017; Lindberg, Stevens, Elder, Funk, & DeBar, 2013; Yoong, Carey, Sanson-Fisher, & D'Este, 2013; Thompson & Thomas, 2000).

Eating disorders are also known risk factors for harmful use of weight loss supplements (Austin, Yu, Tran, & Mayer, 2017). In recent years, the use of weight loss supplements has

steadily increased among US and European adults. About 15% of the US adult population and 10% of European adults use supplements for weight loss (Garcia-Alvarez et al., 2016; Rogovik, Chanoine, & Goldman, 2010; Pillitteri et al., 2008; Blanck et al., 2007). There exists a huge market for a range of slimming aids sold in the US and in Europe, mainly through pharmacies and health stores.

A potential over intake of nutritional supplements have been identified among the Lebanese population, which might be attributed to westernization and urbanization that affected the Lebanese culture and to the large scale marketing campaigns that are usually scheduled through the web to promote supplements (Alaaeddine NM et al 2012; El Khoury & Antoine-Jonville, 2012). However little is known about current use of weight loss supplements in Lebanon.

Knowledge or opinions about weight loss supplements are variable (Al-Safi et al., 2008; Xing, Sharp, & Touchette, 2016). Many people are aware of weight loss supplements from the media and through conversations with family or friends and their widespread availability through community pharmacies have made their use steadily increase among Lebanese people in recent years. Community pharmacists can contribute to weight management by providing advice and support to patients. They frequently encounter people who would benefit from losing weight. Many community pharmacy users discuss obesity issues with pharmacists, who provide them with information on health and illness and advice on healthy lifestyles (Taing M et al 2016; Newlands RS et al 2011). Pharmacists are involved in counseling consumers seeking weight management advice (Fakih, Marriott, Boardman, Anderson, & Hussainy, 2014).

Given the increasing prevalence of obesity in Lebanon, as well as the availability of new prescription weight loss drugs, investigations of weight-control behaviors is needed.

### **Regulation of Weight-Loss Supplements**

Dietary supplements are not regulated as strictly as therapeutic drugs. In the USA, unlike drugs, dietary supplements do not require approval by the FDA before marketing. Supplement manufacturers are responsible for determining that their products are safe and their label claims are truthful and not misleading. However, manufacturers are not required to provide that evidence to the FDA before marketing their products. If the FDA finds a supplement to be unsafe, it may remove the product from the market or ask the manufacturer to voluntarily recall the product. The FDA and the Federal Trade Commission (FTC) may also take regulatory actions against manufacturers that make unsubstantiated weight-loss claims about their products. The FDA does not permit dietary supplements to contain pharmaceutical ingredients, and manufacturers may not promote these products to diagnose, treat, cure, or prevent any disease (U.S. Food and Drug Administration. Q&A on Dietary Supplements. 2016)

Most weight loss supplements available in Lebanon are manufactured abroad and imported to the country by many agents. The Lebanese Ministry of Public Health placed dietary supplements into a special category requiring that each supplement be labeled as a “dietary supplement” and not as a food or a drug. They can be marketed without any scientific evidence to substantiate safety or efficacy. Rules on those products are provided by the Ministry of Public Health in decree 5518 14/12/2010 with the purpose of protecting consumers against potential health risks and side effects of those products and to ensure

that they are not provided with misleading information. A list of banned herbal ingredients is also provided in decree 940/1 29/9/2011.

Alameddine M et al (2011) investigated the regulatory frameworks and the barriers for the proper regulation and integration of complementary and alternative medicines products in Lebanon and reported that several official and unofficial supply channels exist, many of which are beyond the control of the Ministry of Public Health.

Decree number 11710 establishes a committee with the Ministry of Public Health which receives and approves all the requests related to importing, manufacturing and marketing natural medical products and nutritive supplements. None of these products can be introduced on the Lebanese Market without obtaining the approval of the Committee at the Ministry of Public Health.

Four major categories are marketed: Weight loss products, energy/sexual enhancers, body/muscle building and multivitamins. Researchers agreed that the supplements' sector in Lebanon is poorly regulated and a complete reorganization is required.

Some studies suggested strict regulations for the supply and sales of these products for several reasons such as lack of adequate controls, pharmacists' beliefs and lack of adequate pharmacist knowledge (Hackett & Krska, 2012).

## **Ingredients in Weight-Loss Supplements**

**Table 2** summarizes some of the weight loss ingredients.

Weight loss supplements are available as capsules, tablets, liquids, and powders. Manufacturers claim that these products reduce fat and carbohydrate absorption, decrease appetite, burn fat, increase metabolism or induce detoxification.

Multiple ingredients may be available in a single pill (H. L. Lopez et al., 2013). Furthermore, dosages and amounts of active components vary widely among weight-loss supplements, and a product's composition is not always fully described.

New dietary supplements for weight loss are still being developed including white bean extract, *Garcinia cambogia*, bitter orange, *Hoodia gordonii*, forskolin, green coffee, glucomannan,  $\beta$ -glucans, chitosan, guar gum, and raspberry ketones (Ríos-Hoyo & Gutiérrez-Salmeán, 2016).

## **Reasons for skepticism and possible dangers**

Because most supplements promote fast decrease in weight that results in the loss of muscle water and lean body mass, they may interact with medications, may be associated with life-threatening adverse reactions and abuse, they may be adulterated with drugs, have inappropriate formulations and they lack evidence of efficacy and safety, they create a potential risk to consumers.

### **a- Lack of evidence of efficacy**

Most of weight loss supplements have little or no convincing evidence of ability to produce and sustain weight loss. The efficacy of most supplements that alter weight is uncertain

because well designed randomized clinical trials are not available (Laddu, Dow, Hingle, Thomson, & Going, 2011; Onakpoya, Posadzki, & Ernst, 2014). In some cases, claims of benefit are based on small human studies or animal or laboratory studies.

None of the food supplements reviewed by Onakpoya et al (2011) was supported by sound evidence from systematic reviews for generating clinically relevant effects on body weight without undue risks. Many people use them despite little evidence to support their benefit. Some small studies with many limitations have shown some beneficial effects of herbal supplements on weight loss. Weight loss supplements may increase patients' motivation to lose weight and to establish healthy lifestyle changes. A national survey in the United States found that 33.9% of adults who have made a weight loss attempt had used a dietary supplement to do so. It was also found that the use was more common among women, younger adults, minorities, and those with less education and lower incomes (Austin, Yu, Liu, Dong, & Tefft, 2017; Pillitteri et al., 2008). Egras et al (2011) conducted an evidence-based review of fat modifying supplemental weight loss products; they found that conjugated linoleic acid, chitosan, pyruvate, and *Irvingia gabonensis* appeared to be effective in weight loss via this mechanism. Bell et al (2009) reviewed published articles on dietary supplements for weight loss. Effectiveness of these supplements was defined as promoting 0.5 to 1 kg of weight loss each week: chromium picolinate, hydroxyl citric acid, decaffeinated green coffee extract, *Phaseolus vulgaris*.

Patients who used complimentary therapies for weight loss had significantly lower total cholesterol levels compared with patients who did not use supplements and this might have been the result of better habits and healthier lifestyles in users (Amariles, González, & Giraldo, 2006).

**b- Lack of safety**

There is an increasing belief that nutritional supplements are natural and safe. However, they are associated with adverse effects and drug interactions and limited data is available on their safety. In their meta-analysis, Poddar et al (2011) noted that users and non-users of dietary supplements assume that these products have been evaluated for safety and efficacy before being marketed. However, use of some weight loss supplements has resulted in serious health risks such as myocardial infarction, atrial fibrillation, seizures, stroke, gastrointestinal impairment, acute hepatotoxicities and death due to the active ingredients or contamination with chemicals (Kulkarni, Huerto, Roberto, & Austin, 2017; Pendleton et al., 2013; Chen et al., 2010; Karth, Holoshitz, Kavinsky, Trohman, & McBride, 2010). The most recognized example is with *Ephedra sinica* which was a widely used weight loss supplement in the 1990s. The ephedrine alkaloids present in the plant contain sympathomimetic compounds with  $\alpha$ 1-adrenergic agonist activity which affects the central nervous system and the cardiovascular system (Williamson EM 2017). In 2004, the FDA has removed ephedra from the herbal dietary supplement market after reports of adverse events associated with its use including hypertension, arrhythmias, heart attack, stroke, and even death (Greenway, de Jonge, Blanchard, Frisard, & Smith, 2004).

Adverse reactions are also mainly attributed to improper use of weight loss supplements, lack of pharmacy staff knowledge about such products, advice accompanying their sale and if used in patients with medical conditions including hypertension, diabetes or heart disease (Andronicou, Krska, Hackett, & Richards, 2009).

In 2012, in France, the “Agence nationale de sécurité du médicament et des produits de santé (ANSM)” has forbidden the use of 3 plants and 26 active substances in pharmaceutical preparations as they may be associated with an increased health risks. *Garcinia cambogia*, *Hoodia gordonii* and the fruit of *Citrus aurantium* L. ssp *amara* (contains synephrine) can't be administered to humans and still they are available in commercial weight loss products in France and exported to many countries, including Lebanon (Geneslay & Derbré, 2014).

Weight loss supplements contain multiple ingredients and might interact with prescription and over-the-counter medications. For example, glucomannan and guar gum might decrease the absorption of many drugs that are taken orally (Zalewski et al., 2015). Chitosan affects the anticoagulation effect of warfarin by decreasing the absorption of vitamin K (Huang, Sung, & Chiang, 2007). *Garcinia cambogia* was associated with serotonin toxicity in a patient taking the supplement with selective serotonin reuptake inhibitor medications (A. M. Lopez, Kornegay, & Hendrickson, 2014).

Several regulatory agencies highlighted that some dietary supplements may induce health problems with regard to their quality and safety for human consumption. Poor quality control increases the risk of contamination of these products by bacteria, fungi, heavy metals and metalloids (Haidar 2004, Mazzanti et al 2008).

Korfali et al (2013) stated that regulatory agencies in Lebanon highlighted the problems with dietary supplements in terms of quality, effectiveness and safety. However, these regulations are not implemented and not strictly enforced.

Weight loss supplements may be associated with weight cycling and regain over time, and with eating disorders. Products with low efficacy may induce unfavorable effects by leading some patients to become less adherent to recommended lifestyle modifications that have proven efficacy (Tippens et al., 2014). Some studies showed that individuals taking weight loss supplements may eat more due to the feeling that they are liberated from the need to regulate their eating (Chang & Chiou, 2014).

Pomeranz et al (2013) addressed the problem of abuse and misuse of over-the-counter drugs and supplements for weight loss by young people and recommended that an international effort should be made to protect public health and prevent potential harm from these products.

### **c- Counterfeit pills**

Weight-loss products, marketed as dietary supplements, are sometimes adulterated with prescription-drug ingredients, controlled substances, or untested/unstudied, pharmaceutically active ingredients that could be harmful. Amphetamines and derivatives, sibutramine, lorcaserin, fluoxetine and any other pharmaceutical active ingredients should be absent in dietary pills and herbal formulations. However many manufacturers indiscriminately and illegally add these compounds to their pills to accelerate weight loss (Hachem et al 2016; V.B. dos Santos et al 2016; van Hunsel et al 2016; Reeuwijk et al., 2014; Kim et al 2014; Oberholzer et al 2014)

Sadaka et al (2011) tested 34 weight loss products sold in Lebanon to verify whether the composition comply with the label. The study revealed that 15 products were adulterated

with sibutramine, 2 products with phenolphthalein, and 9 products with caffeine. It is important to note that sibutramine was withdrawn from drug market in 2010 due to serious cardiovascular effects.

## **STUDY OBJECTIVES**

### **Primary objectives**

-To explore the knowledge and use of weight loss drugs and supplements in a sample of Lebanese population.

### **Secondary objectives**

-To identify the weight loss supplements and drugs in the Lebanese market and their components.

-To assess socioeconomic, health and lifestyle characteristics related to their use.

## **MATERIALS AND METHODS**

### **General study design and population**

#### **Target population**

The study was conducted, using a convenience sampling of Lebanese adults ( $n=200$ ; with 2 groups of 100 consumers of weight loss supplements and 100 non-consumers) recruited at a pharmacy in Keserwan (Mount Lebanon), between March and July 2018.

#### **Inclusion/exclusion criteria**

The inclusion criteria set for this study are:

- Lebanese adults 18 years of age and older.
- Self-identified nonusers and ever-users (past or current) of weight loss drugs
- Use of substances for weight-loss was defined as the use of any nutritional supplements with the aim of weight loss at least once in their life reported by answering “yes” to the question: “Have you ever taken any type of weight loss supplement?” (appendix 2)

### **Procedure**

In the pharmacy, a briefing of the study objectives was presented to adult customers by the pharmacist. Verbal informed consent was obtained from all subjects prior to participating in the study and completing the self-administered questionnaire in the pharmacy (appendix 2). Those who provided their consent were handled a self-administered anonymous structured questionnaire in Arabic language consisting of four parts that included questions related to sociodemographic, anthropometric, dietary, and lifestyle behaviors and the use, knowledge and effects of weight loss supplements and were assisted by the pharmacist if they needed any help.

Of note, participants were approached at random and recruited to complete the questionnaire, regardless of whether they were underweight, healthy or overweight. Controls are recruited directly after a supplement user has already filled the questionnaire.

### **Study instruments**

Identification of weight loss supplements sold in the Lebanese market was done from the list of food supplements permitted by the Ministry of Public Health and available on the website of the ministry. Medications for weight loss approved and marketed in Lebanon were identified from the Lebanese National Drug Database.

The interview questionnaire included four parts consisting of 36 questions, and a cover page explaining the purpose of the study and ensuring anonymity and confidentiality as well as the consent of study participants.

All survey participants were provided with the legal definition of a dietary supplement defined by the United States Food and Drug Administration:

“A dietary supplement is a product intended for ingestion that contains a "dietary ingredient" intended to add further nutritional value to (supplement) the diet. A "dietary ingredient" may be one, or any combination, of the following substances: a vitamin, a mineral, herb or other botanical, an amino acid a dietary substance for use by people to supplement the diet by increasing the total dietary intake a concentrate, metabolite, constituent, or extract”

#### Part A: Sociodemographic data

In the first part, adults participants' demographic profile such as age, sex, marital status, place of residence, occupation, level of education and personal income were initially recorded with the purpose of depicting demographic and weight-related characteristics of users and non-users of dietary supplements.

#### Part B: Health determinants

Participants involved in this study self-reported their weights and heights. Body mass index (BMI) was subsequently calculated using height and weight as weight in kilograms over height squared (in square meter), and categories were selected based on BMI cut-off points provided by the WHO; Obese, overweight, normal weight and underweight cutoffs are defined according to body mass index (BMI) 30, 25.0–29.9, 18.5–24.9, and 18.5 kg/m<sup>2</sup> respectively. Lifestyle behavior questions such as physical activity habits and medical conditions were also explored to study characteristics of people who use weight loss products.

Part C: SCOFF (acronym created from the questions)

***SCOFF questionnaire:*** The SCOFF questionnaire is an eating disorder screening questionnaire which contains 5 short questions regarding key aspects of eating disorders such as vomiting, concerns about losing control over how much one eats, weight loss, feeling fat and whether food dominates life. Each question should be responded by yes or no. If two or more questions answered by yes, this means that screening for eating disorders is positive (Luck, et al., 2002).

Part D: views related to weight loss supplement use

Assess current and previous practices, beliefs and attitudes related to weight loss dietary supplements. Participants were asked whether they had attempted to lose weight and if they asked for professional assistance. The remaining questions focused on respondents' actions previously taken to reduce weight, determine the prevalence of weight-loss practices and use of substances for weight-loss.

Participants were also asked if they have ever used a weight loss supplement. If their answer was yes, they stated their reasons for self-medication, stated the duration of use, claims that affect buying behavior, side effects, interactions, effectiveness, actual behavior (consumption, purchase).

To assess knowledge and beliefs about dietary supplements, all respondents (regardless of dietary supplement use) are asked questions about the safety, and efficacy of these products.

The questionnaire was completed by participants within approximately 10 minutes.

### **Data Analysis**

Statistical Analysis was performed using Statistical Package for Social Sciences SPSS version 20 (SPSS Inc., Chicago, Illinois).

Descriptive statistics were used to describe population characteristics, patterns of supplement use, and associated information within each targeted population

For statistical analysis, chi-square ( $\chi^2$ ) tests of independence and Fisher's exact tests (for analysis with low expected cell counts) were used to test for relationships between categorical data. All data was considered statistically significant at  $p < 0.05$ .

## **RESULTS**

### **Descriptive analysis**

More than 100 weight loss products were identified with their complete composition in **Table 3**. A total of 200 subjects were interviewed. To evaluate the baseline cross-sectional

relationship between the two groups, we considered users of weight loss supplements as our cases and subjects who never used them as our controls. The sample characteristics are presented in **Table 4**. The majority of the subjects in both groups were adults aged between 25 and 44 years, but subjects who used weight loss supplements were more likely to be 45 years of age or older (37%,  $p=0.001$ ), female (81%,  $p=0.016$ ), married (84%  $p=0.006$ ), house wives or retired (30%  $p<0.001$ ), with lower level of education ( $p=0.012$ ).

**Table 5** describes health determinants of participants. Although excess weight ( $BMI \geq 25$ ) was identified in 46% of non-users and in 60% of users of weight loss supplements, 38% of non-users perceived their weight as over and 57% of users perceived it as over normal range (Table 8) suggesting an unrealistic perception of weight issue. Users of weight loss supplements were more likely to have thyroid diseases ( $p=0.027$ ) and to be smokers ( $p<0.001$ ). SCOFF questionnaire was used as a screening tool for Eating Disorders. It is important to note that users of weight loss supplements were more likely to have positive SCOFF (score  $\geq 2$ ) ( $p=0.019$ ).

The frequency of weight loss attempts and the methods used according to sample characteristics are featured in **Table 6**. The most frequent strategies were diet and physical activity. Users of weight loss supplements were more likely to have attempted to lose weight more than 4 times in their lives ( $p<0.001$ ), to have followed a specific diet ( $p=0.016$ ) and to have used orlistat as a way to lose weight ( $p=0.004$ ). However no statistically significant difference was observed between the two groups with regard to the use of other medications, physical activity or types of diet.

Behaviors of users of weight loss supplements are described in **table 7**. Pharmacies were the most common source of weight loss supplements (87%). It is interesting that 95% of users of weight loss supplements did not inform their doctor about it. The most commonly used weight loss supplement was AB Slim (48%), followed by Clarinol and Mincidetox. Overall, 45.8% reported using weight loss supplements for less than 30 days while 63% admitted that they lost weight but most of them lost only 1 to 5 kg. In most cases the supplement was recommended by a friend (45%) or pharmacist (40%). Subjects who used the supplements perceived their mechanisms of action as fat burners (57%) or appetite suppressants (47%). Most of the participants (95%) agreed that they used the supplement with the purpose of losing weight rapidly, 69% as aid to exercise while only 49% agreed that they used them due to frustration after previous attempts. The most commonly reported side effects experienced by 59% of subjects who took supplements were headaches (40.7%), sleeping disorders (30.5%), nausea (27.1%), respiratory disorders (23.7%) and palpitations (22%).

**Table 8** describes self-perceptions about weight and believes of users and non-users regarding weight loss supplements. Subjects who use weight loss supplements were more likely to believe that herbal products are safer than drugs ( $p < 0.001$ ) and are efficient ( $p < 0.001$ ) and agreed that their weight is over ( $p = 0.007$ ). However non users tended to believe that their weight is normal ( $p = 0.007$ ) and agreed that weight loss supplements are expensive (94%;  $p < 0.001$ ), while no statistically significant difference was observed regarding knowledge about them.

## DISCUSSION

This study explored weight loss supplements brands and their corresponding ingredients as well as attitudes and perceptions of pharmacy consumers regarding these supplements. Our findings suggest a wide range of weight loss supplements available in Lebanon, with more than 100 products offered for consumers. Similarly, previous studies performed in the USA and England identified extensive range of products stocked in pharmacies (Krska, Lovelady, Connolly, Parmar, & Davies, 2010; Sharpe, Blanck, Williams, Ainsworth, & Conway, 2007). However, only 21 products were cited by the participants of our study which may be attributed to the sample population that was taken from one region of the country or to the participants' ability to recall the name of the supplements they used.

The most common ingredients were stimulants and many products included multiple ingredients in a single pill. A previous study done in Europe identified different herbal ingredients consumed for weight control and found that artichoke was the most consumed one, however in this study, artichoke was found in only five marketed products (Garcia-Alvarez et al., 2016).

Other objectives of the study were to explore the knowledge and use of weight loss drugs and supplements and to assess socioeconomic, health and lifestyle characteristics related to their use.

Regarding age, results showed an increased likelihood of use of weight loss supplements in people aged 45 years and older which is in discordance with other publications that found that younger age as being a risk factor for weight loss supplements use (Pomeranz, Taylor, & Austin, 2013). But also, the finding with regard to age is in line with some studies

showing that middle aged adults are more likely to have a higher personal income as compared to younger and hence enabling them access to complementary and alternative medicine (Kharroubi, Chehab, El-Baba, Alameddine, & Naja, 2018; Pillitteri et al., 2008). The consumers of weight loss supplements in this study were predominantly unemployed married women who smoke and have a BMI>25 kg/m<sup>2</sup>. The same profile was identified with other researchers with regard to gender, marital status, employment and BMI of the consumers of weight loss supplements. But different results were found regarding smoking status (Allison, Fontaine, Heshka, Mentore, & Heymsfield, 2001; Blanck et al., 2007; Garcia-Alvarez et al., 2016; Machado, Silveira, & Silveira, Vera Maria Freitas da, 2012; Pillitteri et al., 2008).

Although higher obesity prevalence was identified in Lebanese males, (Mallat et al., 2016), however women try to lose weight and to consume diet food and weight loss supplements more frequently than men (Blanck et al., 2007; Santos, Sniehotta, Marques, Carraça, & Teixeira, 2017).

Marital status and occupation were found to be significantly different between users and non-users of weight loss supplements. We note that in another study, employment and single status of women have been associated with lower weight (Kim & von dem Knesebeck, 2018). Moreover, income was not associated with the use of weight loss supplements in our study although an inverse relationship between obesity and socioeconomic indicators including education was identified in other studies (Chamieh et al., 2015; J. Wardle & J. Griffith, 2001).

Regarding health determinants of participants, users of weight loss supplements were more likely to be smokers reflecting an important association between weight control and

smoking. Low level of physical activity and poor diet are risky behaviors often associated to heavy smoking especially in people with lower socioeconomic status, which lead to weight gain (Chiolero, Faeh, Paccaud, & Cornuz, 2008; Gritz & Crane, 1991).

No statistically significant difference in weight ranges was detected between users and non-users of weight loss supplements which may be explained by the usage of self-reported height and weight to calculate BMI, with a tendency to overestimate height and underestimate weight (Niedhammer, Bugel, Bonenfant, Goldberg, & Leclerc, 2000) and by the small sample size which may not capture a wide range of BMIs especially categories that are not very prevalent such as obesity and severe obesity.

More users of weight loss supplements stated having thyroid disorders. Hypothyroidism is associated with weight gain and the use of weight loss methods (Knudsen et al., 2005).

Our data indicates that the use of weight loss supplements is associated with positive SCOFF. Corroborating these findings, several reports revealed that individuals with eating disorders are at risk of over using orlistat and other substances to control weight (Cochrane & Malcolm, 2002; Fernández-Aranda et al., 2001; Hagler Robinson, 2009; Malhotra & McElroy, 2002; Reba-Harrelson et al., 2008; Steffen et al., 2010). Weight loss supplements may be used as means for compensating binge eating by providing a liberating effect from diet control (Chang & Chiou, 2014).

The increased number of weight loss attempts by users of weight loss supplements is consistent with other studies and indicates persistent unsuccessful efforts to lose weight by multiple methods and alternatively may designate increased awareness regarding healthy weight (Pillitteri et al., 2008; Yoong, Carey, Sanson-Fisher, & D'Este, 2013). This was

also verified through the statistically significant difference observed with regard to diet and use of "orlistat".

Consultation with dieticians has been practiced to a high extent by consumers and non-consumers of supplements and around half of the participants reported doing some physical activity. It is encouraging to know that they believe that diet recommended by medical professionals and exercise help to lose weight. This is consistent with the findings of a national population-based study conducted in Lebanon where most of the respondents favored diet and exercise over prescription medications and surgery (Mallat et al., 2016).

"Orlistat" is readily available in Lebanon and generic products are somehow affordable. Metformin is a biguanide used for the treatment of type 2 diabetes and can lead to moderate reduction in weight and BMI. It was not considered a treatment for weight loss by the participants in our study.

Our data also showed that the use of complementary and alternative therapies for weight loss other than weight loss supplements is low which is similar to findings in a study conducted in the USA (Sharpe, Blanck, Williams, Ainsworth, & Conway, 2007).

Subjects who used weight loss supplements have been reluctant to discuss the issue with their doctors which has also been reported in other studies (El Khoury & Antoine-Jonville, 2012; Yoong et al., 2013). The most frequent sources of recommendations were friends and pharmacists which was also similarly observed in other studies (Andronicou, Krska, Hackett, & Richards, 2009a). The latter may be attributed to the heavy promotion of these products in pharmacies and to the increased revenue related to their sales. Different observations were detected with Australian pharmacists who recommended more meal replacement products compared to weight loss supplements and "orlistat" due to a higher

profit margin with such weight loss programs compared to other options (Taing, Tan, Williams, Clavarino, & McGuire, 2016).

Also worth noting is that although weight loss supplements are marketed worldwide and are readily available over the internet, pharmacies are still the major source for these products in Lebanon because they gain more credibility when purchased through pharmacies. This observation is similar to findings of a study performed in England that found that pharmacies are the major suppliers of over-the-counter weight loss products despite that many pharmacists had limited knowledge of the products (Andronicou, Krska, Hackett, & Richards, 2009) and to other studies done in Australia and found that women are the biggest consumers of weight loss products which are mainly purchased in pharmacies (Fakih, Hussainy, & Marriott, 2014; Hackett & Krska, 2012).

Our data suggest that users of weight loss supplements tend to take more than one kind after failure of the previous ones to help them reach expected weight loss. Factors that might also be associated with notable increase in their use are their widespread availability and easy accessibility. In our study, 63% of participants who used weight loss supplements admitted to lose weight. This is contradictory with several studies showing that the great majority of weight loss supplements lack compelling evidence of effectiveness (Laddu, Dow, Hingle, Thomson, & Going, 2011; Onakpoya, Wider, Pittler, & Ernst, 2011).

High rates of side effects were reported in this study, which was also identified in the literature (Pittler, Schmidt, & Ernst, 2005). However, it is difficult to confirm causality since taking a placebo may dispose subjects to think that usage of a pill will induce side effects (Tippens et al., 2014). Headaches, sleeping disorders, nausea, respiratory disorders

and palpitations were the most commonly reported side effects, which are also frequently associated to “sibutramine” (Jenna Tucker et al., 2018).

Respondents who reported adverse events stated the use of the same product; AB slim. Coincidentally, on the twentieth of June 2018, the US food and drug administration advised consumers not to purchase or use AB Slim for weight loss. This product was identified by FDA during an examination of international mail shipments. FDA laboratory analysis confirmed that AB Slim contains “sibutramine”, “phenolphthalein” and “sildenafil” which are known to be frequent adulterants of weight loss products. Consequently, on the first of October 2018, the Lebanese Ministry of Public Health issued a decision (number 1867/1) to stop the selling of AB slim on the Lebanese market after being available since 2012, due to the presence of sibutramine in the product.

In accordance with other studies, a high percentage of users of weight loss supplements perceive them as being safer than medications and harmless. The consistency of these results reinforces the fact that supplements made of herbal ingredients are generally considered safe by consumers (Ansari & Omar, 2017).

## CONCLUSION

Our study represents the first attempt at analyzing non-prescription supplements for weight loss in the local market and provides information on who is using them and about ingredients included in these products. A serious public health concern was highlighted in this study related to the unguided over intake of weight loss supplements.

Our findings should inspire the implementation of further studies at the national level assessing the prevalence of use of weight loss supplements and associated side effects.

Ministry of Public Health should be more skeptical before approving supplements and practice tighter regulations. Governmental laboratories are required to analyze products and search for possible adulteration with pharmaceutical active ingredients.

Community pharmacists are involved in the provision of such products. The role of pharmacists in weight management should be clearly defined, they could be valuable and serve as a rapid accessible source of information regarding evidence-based weight management strategies, they are potential sources of advice and can push patients to increase adherence to weight loss strategies.

## **STRENGTHS AND LIMITATIONS**

All the information regarding height, weight, weight loss attempts are self-reported which could be a source of bias due to the possibility of misreporting. The small sample permitted limited stratification and no regression analyses for assessing the association between independent variables and the consumption of weight loss supplements and identifying significant predictors. The study was restricted to one pharmacy in Lebanon and therefore may not reflect practices in pharmacies in other regions.

The strengths of this study include the gathering of information on the range of weight loss products available in Lebanon. To our knowledge, no other studies were performed in Lebanon to investigate the content of available weight loss supplements available on the market.

The data was collected by face-to-face interviews which makes it more reliable. As noted above, our data give further support to the opinion that dietary supplements require tighter

analysis for safety and effectiveness before approval, for the purpose of protecting Lebanese consumers from harmful products.

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## APPENDICES

### 1- Informed consent

#### Weight loss supplements on the Lebanese market: safety, efficacy and use.

The study aims to examine the Lebanese consumer perception about weight loss dietary supplements in term of safety, efficacy and use. The association with some socio-demographic and health determinants will be investigated.

You will be interviewed individually. There is no risk in participating in this study. The information collected will be used only for research purpose. You will not be asked to provide your name or any other personal identifier. All data will be maintained in a secure location, and access will be strictly limited to study investigators. Your participation will be extremely helpful and highly appreciated.

A dietary supplement, as defined by the FDA, is a product taken by mouth that contains a "dietary ingredient" intended to supplement the diet. "Dietary ingredients" may include vitamins, minerals, herbs or botanicals (plant based extracts), amino acids, and/or substances such as enzymes, metabolites, constituents and or extracts.

For any further clarifications about the study, you can contact the researcher: Suzanne Bteich (03974496)

#### STATEMENT OF CONSENT:

Being informed that any particular treatment or procedure may involve risks which are currently unforeseeable; I, name: \_\_\_\_\_, state hereby that my participation in the research study is voluntary. Any refusal to participate will involve no penalty or loss of benefits to which I am entitled. I may as well discontinue participation at any time without penalty or loss of benefits to which I am entitled.

\_\_\_\_\_

Signature(s) of the participant(s)  
Researcher (LR)

or guardian

\_\_\_\_\_

Signature of the Leading

Date: \_\_\_\_\_

## 2- Interview questions

### **PART A: SOCIODEMOGRAPHIC DATA**

1-Date of birth -----

2-Gender Male ☐ Female ☐

3-Marital status

Married ☐ Single ☐ Divorced ☐ Widowed ☐

4-Occupation

Student ☐ Self-employed ☐ Employee ☐ House wife/ retired ☐

5-Region where you mostly live

Beirut ☐ Mount Lebanon ☐ North ☐ South ☐ Bekaa ☐

6-Your personal income per month (LBP)?

Below 1500000 ☐ 1500000-2999999 ☐ 3000000-4500000 ☐ Above 4500000 ☐

7-Level of education Field:.....

Complementary level ☐ High school ☐ Bachelor ☐ Master ☐ Doctorat ☐

### **PART B: HEALTH DETERMINANTS**

8-Height (cm)-----

9-Current weight (kg)-----

10-Do you suffer from any of the following medical conditions?

Diabetes Yes ☐ No ☐

Dyslipidemia Yes ☐ No ☐

Cardiac disease Yes ☐ No ☐

Hypertension Yes ☐ No ☐

Thyroid disease      Yes ☐                      No ☐

Other, specify      -----

**11-Are you treated with any medication/supplement chronically?** Yes ☐ No ☐

If Yes why:..... name them:.....

**12-Do you currently smoke?**

Yes ☐

No ☐

If yes, how many cigarettes in a typical day?.....

### **PART C: SCOFF**

**13-Do you make yourself sick because you feel uncomfortably full?** Yes ☐ No ☐

**14-Do you worry you have lost control over how much you eat?** Yes ☐ No ☐

**15-Have you recently lost more than 6.5 kg in a three-month period?** Yes ☐ No ☐

**16-Do you believe yourself to be fat when others say you are too thin?** Yes ☐ No ☐

**17- Would you say that food dominates your life?** Yes ☐ No ☐

### **PART D: SUPPLEMENT/MEDICATION USE FOR WEIGHT LOSS**

**18-Have you ever made an attempt to lose weight?**

Never ☐

1-2 times ☐

3-4 times ☐

More than 4 times ☐

**If yes using what?**

Diet ☐ Behavioral therapy ☐ Physical Act ☐ Supplements ☐ Mdct ☐ Surgery ☐ Other...

**19-Have you ever been treated with any of the following medications?**

Orlistat (Xenical, Eliza)

Yes ☐

No ☐

Metformin (Glucophage, Siofor, Dianorm)

Yes ☐

No ☐

Liraglutide (Victoza, Saxenda)

Yes ☐

No ☐

**20-If you used any medication, did you lose weight? Yes ☐ No ☐**

**If yes, how much during which period time?.....**

**21-Did you use any alternative therapy to lose weight?**

Acupuncture Yes ☐ No ☐

Yoga Yes ☐ No ☐

Massage Yes ☐ No ☐

Other, specify-----

**22- Did you follow any specific diet? Yes ☐ No ☐**

**If yes, who recommended the diet for you?.....**

**Please describe the diet:...**

**23-Do you perform any physical activity PA?**

No ☐ Yes ☐

Less than 30 min/day ☐ 1-2 times/ week ☐

30 min/day ☐ 3-4 times/ week ☐

More than 30 min/day ☐ More than 4 times/ week ☐

**24-Have you ever taken any type of weight loss supplement? (if no, proceed to question 35)**

Yes ☐ No ☐

**25- If yes, what was the source?**

Online shopping ☐ Pharmacy ☐ Grocery ☐ Other specify-----

**26-If yes, did your doctor know about it? Yes ☐ No ☐**

**27- Please name or describe the supplement(s) that you used -----**

**28- For how long did you use the product(s)? .....weeks**

**29- How much weight did you lose by using the supplement(s)?**1-5kg ☐6-10 kg ☐More than 10kg ☐**30-Who recommended the supplement for you?**Pharmacist ☐Doctor ☐Dietician ☐Media ☐Friend ☐Other ☐ specify.....**31-How in your opinion this/these product(s) acts?**

Appetite suppressant

☐

Fluid drainer

☐

Fat burner

☐

Detox

☐

Other (specify)

☐-----**32-Why did you use a dietary supplement/medication for weight loss?****Agree    Disagree**

Desire for rapid weight loss

☐☐

Aid to exercise and diet

☐☐

Frustration with previous attempts at dieting and/or exercise

☐☐

Other ...

**33-Did you encounter any side effect when you used a weight loss supplement/medication?**Yes ☐No ☐**34-If yes, what were the symptoms? Please check all symptoms you have ever experienced**

Constipation

Yes ☐No ☐

Diarrhea

Yes ☐No ☐

Nausea

Yes ☐No ☐

Vomiting

Yes ☐No ☐

Abdominal pain

Yes ☐No ☐

Skin Irritation (rash, itching, hives)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Sleep disturbances	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Headaches	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Respiratory problems	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Urinary problems	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Other (if yes please specify)	Yes <input type="checkbox"/>	No <input type="checkbox"/>

.....

**35-Do you believe that weight loss supplements made from herbs and natural substances are safer than prescription medications? Yes ☐ No ☐**

**36-About weight and use of supplements/ medications for weight loss**

	Agree	Disagree
I believe my weight is		
-Within normal range	<input type="checkbox"/>	<input type="checkbox"/>
-Over the normal range	<input type="checkbox"/>	<input type="checkbox"/>
-Under the normal range	<input type="checkbox"/>	<input type="checkbox"/>
I believe they are not safe	<input type="checkbox"/>	<input type="checkbox"/>
I believe they are not efficacious	<input type="checkbox"/>	<input type="checkbox"/>
I do not know enough about them	<input type="checkbox"/>	<input type="checkbox"/>
They are expensive	<input type="checkbox"/>	<input type="checkbox"/>
Other opinion.....		

## TABLES

**Table 1: Drugs approved as adjuncts to diet and exercise for treatment of obesity**

(Georgios Valsamakis, Panagiota Konstantakou, & George Mastorakos, 2017)

Drug	Drug description	Usual dosing adults
Orlistat	Pancreatic lipase inhibitor	120 mg three times daily with fat-containing meals.
Lorcaserin	Serotonin-2C receptor agonist	10 mg twice daily; to be re-evaluated after 12 weeks.
Phentermine-topiramate	Amphetamine derivative/ GABA inhibitor	Initial: 3.75 mg phentermine/23 mg topiramate once daily in the morning for 14 days. Then titrate based upon response: 7.5 mg phentermine/46 mg topiramate daily for 12 weeks, then 11.25 mg phentermine/69 mg topiramate daily for 14 days. Maximum dose: 15 mg phentermine/92 mg topiramate daily; re-evaluate after 12 weeks.
Bupropion-naltrexone	Opioid antagonist/ aminoketone antidepressant combination	Maximum dose: 32 mg/360 mg daily
Liraglutide	GLP-1 agonist	Initial: 0.6 mg subcutaneously daily. Increase at weekly intervals (1.2, 1.8, 2.4 mg) until recommended dose of 3 mg daily; re-evaluate after 16 weeks

Abbreviations: GABA,  $\gamma$ -aminobutyric acid; GLP-1, glucagon-like peptide-1.

**Table 2: Ingredients of weight-loss supplements**

Common ingredients in weight loss supplements	Comments (active ingredients, mechanism of action, possible side effects)	References
Apple cider vinegar	Suppression of hepatic glucose production, increased glucose utilization, reduction in lipogenesis, increase in lipolysis, increased satiety, and enhanced energy expenditure	(Petsiou, Mitrou, Raptis, & Dimitriadis, 2014)
Banaba	Hypoglycemic effects (corosolic acid as well as ellagitannins)	(Stohs, Miller, & Kaats, 2012)
Bitter orange <i>Citrus aurantium</i>	Contains alkaloids that are adrenergic agonists synephrine increases metabolic rate (Some safety concerns reported)	(Astell, Mathai, & Su, 2013)
Caffeine	Increases fat oxidation and thermogenesis	(Poddar, Kolge, Bezman, Mullin, & Cheskin, 2011)
Capsaicin	Increases energy expenditure via thermogenesis, promotes fat oxidation	(Poddar et al., 2011)
<i>Caralluma fimbriata</i>	Appetite suppressing effects attributed to the pregnane glycosides	(Astell, Mathai, & Su, 2013)
Cascara	( <i>Rhamnus purshiana</i> ) acts as a laxative	(Saper et al., 2004)
Chia seeds ( <i>Salvia hispanica</i> )	Could promote a reduction in the inflammatory response improves insulin resistance	(Martha Guevara-Cruz et al., 2012)
Chitosan	Cationic polysaccharide, and is a derivative of a chitin found in shells of invertebrates, such as crabs and shrimp Has a highly adsorptive surface Binds dietary fat in the digestive tract	(Jull, Ni Mhurchu, Bennett, Dunshea-Mooij, & Rodgers, 2008 ;Allison et al., 2001)
Chromium	An essential trace element involved in carbohydrate and fat metabolism Stimulation of neurotransmitters responsible for eating behaviors Increases lean muscle mass; promotes fat loss; and reduces food	(Tian et al., 2013; Allison, Fontaine, Heshka, Mentore, & Heymsfield, 2001)

	intake, hunger levels, and fat cravings chromium picolinate in daily dosages of 200 to 400 mcg	
<i>Coleus forskohlii</i> (forskolin)	Enhances lipolysis and reduces appetite	(Astell, Mathai, & Su, 2013)
Country mallow	Diuretic	(Saper, Eisenberg, & Phillips, 2004)
Conjugated linoleic acid	Reduce body fat content and increase lean body mass; promotes apoptosis in adipose tissue	(Allison et al., 2001)
<i>Cynanchum Auriculatum</i> (roots)	According to Chinese traditional medicine, enhances immunity and espouse longevity Contains pregnane glycosides with potential appetite suppressant effect	(Liu et al., 2013)
Dandelion	Diuretic effect, and laxative properties	(Saper et al., 2004)
Fucoxanthine	Increases energy expenditure and fatty acid oxidation, suppresses adipocyte differentiation and lipid accumulation	(Wan-Loy & Siew-Moi, 2016, Hu et al., 2012)
<i>Fucus vesiculosus</i>	Alga rich in alginate and iodine iodine increases thermogenesis, alginates increase sensation of satiety, reduces fat absorption	(Gabbia et al., 2017 ; Chater et al., 2016)
Ginseng	<i>Panax ginseng</i> may improve glucose tolerance	(Saper, Eisenberg, & Phillips, 2004)
Guarana	Caffeine (stimulant of the Central nervous system, diuretic effect, lipolytic effect in vitro)	(Pendleton, Brown, Thomas, & Odle, 2013)
Guar gum	Acts as bulking agent in gut, delays gastric emptying, increases feelings of satiety	(Poddar et al., 2011)
Glucomannan ( <i>Amorphophallus konjac</i> )	Rich in fibers, increases satiety, laxative effect, prolongs gastric emptying time	(Brownlee, Chater, Pearson, & Wilcox, 2017; Poddar et al., 2011)
Green coffee bean extract	Inhibits fat accumulation, modulates glucose metabolism Can affect appetite hormones	(Gavrieli et al., 2013)

Green tea ( <i>Camellia sinensis</i> )	Epiogallocatechin-3-gallate (EGCG, 48%–55%) Stimulation of sympathetic nervous system, leading to increase in energy consumption, fat oxidation antioxidant and antiobesity effects, reduces lipogenesis and fat absorption	(Astell, Mathai, & Su, 2013; Jurgens et al., 2012; Poddar et al., 2011)
Guggul	Enhances the body's metabolic activity by improving thyroid function, increasing the body's fat-burning activity, and augmenting thermogenesis	(Verma & Paraidathathu, 2014)
Hoodia gordonii	Inhibiting appetite by altering the neuropeptide pathways of the central nervous system, increases adenosine triphosphate production	(Poddar et al., 2011)
Hydroxycitric acid ( <i>Garcinia cambogia</i> )	Inhibition of citrate lyase enzyme, inducing satiety decreases fatty acid synthesis	(Márquez, Babio, Bulló, & Salas-Salvadó, 2012)
<i>Irvingia gabonensis</i>	Soluble fibers in the seeds delay stomach emptying, leading to a more gradual absorption of dietary sugar	(Ngondi, Oben, & Minka, 2005)
L-carnitine	Cofactor in cellular fat oxidation, which is diminished in obesity because of a reduction in L-carnitine enzyme-related activity, increases fat oxidation, decreases fat synthesis	(Poddar et al., 2011)
Licorice	Reduces body fat mass	(Saper et al., 2004)
<i>Moringa oleifera</i>	Antidiabetic, antihyperlipidemic effects	(Stohs & Hartman, 2015)
Mulberry Leaf Extract ( <i>Morus alba</i> L.)	Reduces glucose absorption	(Kan et al., 2017)
Phaseolus vulgaris (white kidney bean)	Interferes with breakdown and absorption of carbohydrates by acting as a "starch blocker"	(Poddar et al., 2011)
Psyllium	Water-soluble fiber derived from the husks of ripe seeds of <i>Plantago ovata</i> Improves glucose and lipid parameters Improves satiety, lowers appetite	(Poddar et al., 2011; Saper et al., 2004)

Pyruvate	Increases lipolysis and energy expenditure	(Onakpoya, Hunt, Wider, & Ernst, 2014)
Raspberry ketone	Alters lipid metabolism in adipocytes	(Park, 2015)
Spirulina	Also known as blue-green algae contains phenylalanine, which is purported to inhibit appetite	(Saper et al., 2004)
Seaweed	Alginates strong gelling fibers may induce increased feelings of satiety and reduce energy intakes	(Morten Georg Jensen, Mette Kristensen, & Arne Astrup, 2012)
Yerba mate	Caffeine, appetite suppression	

Table 3: Weight loss products available on the Lebanese market

Product	Composition	Country of origin
100% Lipo 30 capsules forte Pharma	Green tea extract titrated 7% caffeine (Camellia sinensis), dry extract of guarana titrated at 12% caffeine, papaya 100mg vitamin c (120mg), ginger (100mg), black radish 100mg, vitamin b3, Foeniculum Vulgare) (100)	Monaco
4321 Minceur Ultra Draineur 280ml	Aqueous extracts of plants [obtained from 509 mg Camellia sinensis, 413 mg green coffee bean (Coffea arabica, Coffea canephora), 390 mg Foeniculum vulgare, 340 mg Ilex paraguariensis, 290 mg de graine de Guarana (Paullinia cupana), 172 mg de racine de Chicorée (Cichorium intybus), 172 mg de partie aérienne de Pissenlit (Taraxacum officinale), 137 mg Cola nitida, 15 mg Raphanus sativus var. niger, 15 mg Hieracium pilosella per dose of 20 ml]	France
AB Slim-Slim Cellulose 30 capsules	Rhizoma Atractylodis, Macrocephalae, Cassia Seed, Liquorice, Dried Ginger, Ginseng	China
Acai Berry 1000mg 120 capsules Alfa vitamins laboratories	2 capsules: Acai berry 1000 mg	USA
Acai berry genesisvit	2 capsules 1000mg	USA
Acai boost 4G 60 caps	acai berry extract 100mg, resveratrol 10mg, Garcinia cambogia extract 150mg, Green coffee bean extract (standardized to 50% chlorogenic acids) 200mg, green tea extracts 50mg, ginger extract 10mg, dandelion extract 50mg	Lebanon
Acai 1000mg 21st century healthcare 60 capsules	2 capsules acai berry 1000 mg	USA
Advancis Drena (500ML)	Erva mate, guarana	Portugal

Advancis extra slim gold (30 tabs, 30 capsules, 20 tabs)	Day Formula – 30 Tablets of 900 mg. L-Carnitine, Chromium and Fibers Meals Formula – 30 Capsules of 770 mg. Chitosan, Vitamin C, Fructooligosaccharides and Cinnamon Night Formula – 20 Capsules of 1 820 mg. Conjugated Linoleic Acid	Portugal
Advancis Extra Slim Night Formula + Day Formula 30+30 Tabs	DAY formula Garcinia, Chromium, L carnitine fibers Night formula: CLA	Portugal
Advancis fat blocker	Chitosan, Vitamin C, Fructo-Oligosaccharides and Cinnamon 770mg	Portugal
Advancis Lipo 3 90 capsules	Chromium trichloride 372mcg + Garcinia cambogia 400MG + L-Carnitine 250 mg + glycine max 300mg, phosphatidyl inositol 42mg, phosphatidyl choline 69 mg, apple tree 150 mg	Portugal
Advancis CLA+Green Tea+Yerba Mate	Complex of CLA + Green Tea + Yerba Maté + Vitamin E 1200mg	Portugal
Alcarex	L carnitine 500 mg	Lebanon
Appeti Light Forte Pharma 60 capsules	In 4 capsules: Pectirégul : Nopal 260 mg, apple pectin 160 mg Chondrus crispus 10 mg, guar gum 280 mg fructo-oligosaccharides 200 mg Laminaria 40 mg, Guarana 80 mg, Maté 80 mg, Thiamine (vitamine B1) 1,4 mg, Niacin (vitamine B3) 18 mg, Vitamine B6 2 mg, vitamine B5 6 mg Zinc 14 mg, chromium 25 µg 62% Iodine 150 µg	France
Apple Cider Vinegar 21st century healthcare 100 tablets	1 tablet: cider vinegar 300mg, Calcium (as calcium carbonate) 115mg	USA
Aqua Ligne Reduce L'Appetit 60 Capsules Konjac	2 capsules: Konjac extract (glucomannan 1g)	France
Aqua Ligne Bruler Les Graisses(28 Comps) Jour & Nuit	Day tablets: Chitosan, extracts of : garcinia, cocoa (50 mg), green coffee beans, matte (50 mg) Night tablets: extracts of garcinia (250 mg), grape marc (50mg), orange bark (50 mg)	France

Aqua Ligne Brule-Graisse+Ventre Plat (20 Sachets)	1 sachet: Guarana 500mg, peppermint 1500 mg	France
Aqua ligne brule-graisse+draineur (20 sachets)	1 sachet: Guarana 500mg, elderberry extract 345 mg	France
Bio-CLA	CLA	France
Calorease fbcx	1 tablet alphacyclocloextrin 1000 mg	Switzerland
Calorie Light Forte Pharma	2 capsules: Cocoa fibers (Theobroma Cacao) 320mg, orange fibers (Citrus Aurantium Dulcis) 320 mg	France
Captoredux Forte Pharma	Gastric release outer layers: 600 mg KAPTUFAT600. Internal intestinal release layer: Captocarb® 50 mg	France
Carb X Natural Balance	Composition for 2 capsules: Chromium (as chromium picolinate) 200mg white kidney bean extract (phaseolus vulgaris) 600 mg Wheat extract (germ) 200 mg Green tea (leaf extract, camellia sinensis) 200mg	USA
Carbo Slim Healthaid 60 tablets	2 capsules: White Kidney Bean Extract 500 mg, chromium 100mcg, Standardised Green Tea Extract (min 60% polyphenols & 40% catechins) 100 mg	UK
Carnivtia chewable tablets	L-carnitine 500mg	
Cebolix 30 capsules	brown seaweeds Ascophyllum Nodosum, fucus vesiculosus 500mg	
Cla Gnc Total Lean 90 softgels	Conjugated linoleic acid (from safflower oil) 2000 mg	USA
Cla Thermo	Conjugated linoleic acid 480 mg, green tea 180mg	USA
Clarinol XS	Composition for 3 capsules: Conjugated linoleic acid: 2160 mg L carnitine L tartrate: 202.5 mg	Switzerland

Centrol Fit Gum	Composition per 1 gum green coffee extract, green tea extract, L-carnitine, and chromium.	
Chitosan alfa (60 caps)	Chitosan: 600mg	
Control diet 90 capsules	colodecaballo fucus 400MG	
Detoxase	Ingredients and supply components for herbal daily dose 1 stick- pack (3g) / 100g: Lespedeza (Lespedeza capitata mich.) Summit es std. 4% rutin 5 00mg / 16,66g, RUTIN 20mg / 667mg • Senna (Cassia senna L.) leaves es std. 6 % sennoside 150mg / 5g, sennoside from senna 9mg / 300mg • Wasabi (Wasabi ( Miq.) Matsum) root es 100mg / 3,34g • Rutin 50mg / 1,67g	
Earth's Creation 30 tablets	L-Carnitine Tartare (1000mg)	USA
Easy slim box detox advancis	Advancis drena + Advancis CLA+ Advancis hepax + advancis essential	Portugal
Easy slim 30 tablets	Garcinia cambogia	
Expuryl 60tabs phytodraineur & detoxiquant codifra	2 tablets contain blackcurrant extract 160mg, artichokes 180mg, dandelion 180mg, melon water 160mg, cinnamon 50 mg, chromium 25mcg	
Fat burner Mason 60 tablets	2 tablets: chromium 200 mcg, calcium 180 mg, Garcinia cambogia (standardized to 60 % hydroxyctic acid) 500 mg, griffinia seed extract 50 mg, thermogenic herbal blend 600 mg (yerba matte extract standardized to 10% alkaloids, guarana seed extract supplying 40 mg caffeine, green tea leaf extract supplying 40 mg caffeine, cinnamon bark standardized to 1% trimeric and tetrameric A type polymers)	USA
Forte bio minceur ampoules	Green tea, Chinese white tea, horsetail	France
G4slim	Green coffee bean extract 200mg	Lebanon

	Garcinia cambogia extract 300mg Dandelion 50mg Chromium 400mcg Ginger extract 10mg	
Garcinia cambogia 90caps sundown	Garcinia cambogia 1000MG	USA
Garcinia cambogia (60 caps) broadmed	Garcinia cambogia 1000MG	USA
Garcinia cambogia alfa vitamins	Garcinia cambogia 1200MG 60% hydroxycitric acid	USA
Gluko 100 forte 30 capsules	glucomannan 100	Italy
golden slimming 60 capsules	Lemon Seed, LCamitine, Green Tea, Bitter Orange Artichoke Bioflavonoids Marine Algae, Ginger Root, Garcinia Cambogia	
Green Coffee Bean 400mg Sundown 60 capsules	Green Coffee Bean 400mg	USA
Green coffee bean complex(60caps) broadmed	Green Coffee Bean 400mg	USA
Green Tea Sundown 90 capsules	Green Tea 630mg	USA
Holistimince 3 in 1 64 capsules	marc de raisin, laitue marine, extrait de the vert	France
Herbal youth gracinia extreme 3000 60 capsules	Garcinia cambogia 500mg 95% HCA	USA
Hydroxycut hardcore 100mg 100 tabs	PER 2 Capsules: caffeine anhydrous 270mg, green coffee extract 200mg, coleus extract 100mg, l-theanine 100mg, cocoa extract 100mg, yohimbe extract 56.3 mg	

Kalory Emergency Diur 60 Tablets	nopal and phaseolamin, with chrome and plant extracts of mouse-ear hawkweed and Ortosiphon	Italy
Kalory emergency 1000	Chromium, Amino Acids and Phaseolamin, Nopal and Fennel	Italy
L carnitin 500mg 30 caps supravit	L carnitine 500 mg	USA
L carnitine 1000mg (20 amp) nature essential	L carnitine 1000mg	USA
L carnitine 500mg 30 tabs sundown naturals	L carnitine 500mg	USA
L carnitine 500mg 60 caps alfa maximum	L carnitine 500mg	USA
L carnitine 100 caps bodyshaper	L carnitine 500mg	
L'organica	Composition per 1 capsule: white tea extract 270mg, garcinia 50mg, guarana 100mg, caffeine 30 mg, aloe ferox, 10mg, L carnitine 5 mg, Cayenne pepper 5 mg	Unknown
Lean fit	guarana paulina seed extract (caffeine 12%) 250mg, inulin 200mg, garcinia cambogia 150mg, choline 41.25 mg, ginger root extract 50mg, capsicum fruit extract 25mg, chromium 20mcg	LITHUANIA
Lipo 6 nutrex ultra conc 60 capsules	2 caps: caffeine anhydrous 200mg, synephrine hcl 20mg, guggulsterone 20mg, bioperine 5 mg, yohimbine 3mg	
Liporedux 56 capsules	sinetrol (guarana) 900mg	France
Lipoxyne (eric favre)	4 capsules: l-carnitine 1000 mg ; leucine 125 mg; asparagine – acide aspartique 109mg ; glavonoïd ™: methionine from glycyrhiza glabra 1.100mg ; valine 80 mg lysine 79 mg ; alanine ; glutamine – acide glutamique ; histidine ; 54ethionine54ne ; glycine; arginine ; proline ; 54ethionin ; extrait de thé vert 20 mg ; tyrosine ; tryptophane ; methionine ; cysteine ; isoleucine ; iron (organic) 2.23mg ; ornithine.	FRANCE

Lipoxit 60 capsules	caffeine 60mg, ALA 30mg, CLA 30mg, Camellia sinensis 70mg, Choline 30mg, Chromium 10mcg, L-tyrosine 70mg, Salix alba 80mg, Acetyl-L-Carnitine 60mg	Canada
Lypotrol 60 tablets	Sinetroil (patented citrus fruits) 450mg	Sweden
Minceur 100% lipo 30 gelules triple action forte pharma	2 capsules: Green tea extract 300 mg, vitamin C 120 mg, guarana extract Zingiber Officinalis 100mg, Raphanus Sativus 100mg, Foeniculum Vulgare 100 mg, Carica Papaya 100mg, Vitamin B3 18 mg, Zinc 2 mg, chromium 5mcg	France
Minceur 24+ 28 tablets	Day tablet horsetail zinc , matte, guarana, kola, CLA, chromium, zinc Night tablet: rosemary olive coQ10 chromium	France
Minceur 24 fort men 14 tablets day, 14 tablets night	Day: Matte guarana cocoa CLA Night: rosemary olive coQ10 chromium	France
Minceur 24 fort	Day: horsetail zinc paprika Night: Olea europea + Rosmarinus officinalis + Phaseolus vulgaris, chromium collagen, vitamin B3 elastin	France
Minceur 24 fort 45+	Day: horsetail, zinc paprika Night: chromium, biosilica, 200 mg collagen, elastin, vitamin B8, Coenzyme Q10, vitamin B2	France
Minceur specific ventre plat 28 tablets	100 mg L carnitine, coriander 100mg, caraway 1500mg Lactic acids (probiotics) 5 billion UFC	France
Minceur Turbo Draine 500mL	Meadowsweet, raspberry, concentrated juice of lemon, pomegranate and sea buckthorn, selenium, manganese	France
Minceur Retention d'Eau 45+ 28 tablets	Dried extracts of green coffe, yam, ash tree, caffeine, magnesium, potassium, zinc, dried extracts of blackcurrent, cherry tail, pomegranate, artichoke, selenium, manganese, chromium, vitamin B6, B1, B2	France
Mincidetox 14 sticks	potassium 500mg, calcium 200mg, magnesium 75mg, dandelion 800mg, green matte 1000mg, grape seeds 250mg	France
Mincigrap (marc de raisin) 45 capsules	Grape seeds extracts 390 mg	France

Nature Essential-L-Carnitine 1000mg 20 vials	L-carnitine 1000 mg	Spain
Nutreo adipill (40 cap) métabolisme des graisses minceur 3d	For 4 capsules: CLA 1000mg, Carthamus tinctorius, dried extracts of guarana 240mg (34 mg caffeine)	France
Nutreo kalori track (30 tablets)	For 2 tablets: powder from cladodes de Figuier de barbarie Opuntia ficus indica (2000 mg)	France
Nutreo detox flash 5j (10 tablets)	Dried extracts of Silybum Marianum L. Fruit 440 mg, Articoke Cynara Scolymus L. Bractée 170 mg – dried extracts of Curcuma Curcuma Longa L. 76 mg - Bacillus Coagulan Sporulé 20 mg – dried extracts of Cichorium Intybus L. Root 20 mg – essential oils of Origanum Majorana L. 10 mg	France
Nutreo pectiligne coupe-faim	Apple pectin 3.6g	France
Nutreo total 4 ventre plat( 60gelules )	for 2 capsules: Arabic gum 170mg, inulin from chicory, activated charcoal 120mg, green argila 100mg, natural caffeine 80mg, ascorbic acid 80mg, manganese 2mg, essential oils of Origanum Majorana L. (10 mg), chromium picolinate (Chromium 25mg)	France
Oenobiol remodelant 60 capsules	Composition for 6 capsules L-Arginine : 150 mg Conjugated linoleic acid (CLA) : 1,8 g Chromium : 25 µg	(Sanofi Aventis) France
Reductin minceur	Nopal, safran, (satiéral), cinnamonn, chromium, guarana, caffeine, magnesium, reine des pres	
Reductin cellulite	curcuma phytosome, superoxide dismutase, reine des pres, marron d'inde, fragon, orthosiphon, gamma linoleic acid	
Redukil 60 capsules	Glucomannan 500mg	Spain

Siber Slim Healthaid 60 tablets	2 tablets: L arginine 100 mg, Ginger extract 20:1 (equivalent to 2000mg of Ginger powder) 100 mg, L-Ornithine 100 mg, Apple Cider Vinegar 100 mg, Seaweed Powder 100 mg, Green Tea extract 40 mg, L-Methionine 100mg, Siberian Ginseng extract 15:1 (equivalent to 1800mg of Siberian Ginseng powder) 120 mg, Guarana extract 4:1 (equivalent to 320mg of Guarana powder) 80 mg, Hydroxycitric Acid 100 mg, White Kidney Bean 100 mg, chromium 100 mcg	UK
Slimming aid 100tab holy land 131	Passiflora leaves and flowers, Chamomile, Thyme, Ephedra, Sage, Liquorice, Foeniculum vulgare seeds, Crataegus oxycantha, Cassia angustifolia	
Soft slim 60 capsules	Guarana 16 %, Jobstears 18%, Aloe Vera 21 %, Artemisia Dracunculus 12%, Psyllium Husk 17 %, Bamboo Shoot 7%, and Lotus Leaf 9%.	
Solaray acai fruit 500mg 60comps	Acai berry extract 500 mg	USA
Solaray acetyl l carnitine 500mg 60 tabs	Acetyl L-carnitine 500mg	USA
Solaray alpha lipoic acid 250mg 60caps	Alpha lipoic acid 250 mg	USA
Solaray alpha lipoic acid 50mg 30tab	Alpha lipoic acid 50 mg	USA
Solaray dandelion 100tab	Taraxacum officinal 520mg	USA
Solaray green tea 250mg 30tab decaffe	Green tea extract 250 mg	USA
Solaray green tea 675mg 30tab	Green tea extract 675 mg	USA
Solaray guggul 450mg 60caps	Guggul 450mg	USA
Solaray l carnitine 500mg 30t	L carnitine 500mg	USA
Solaray spirulina 410 100tab	Spirulina 410 mg	USA

Solaray super chitosan (nat max)	Chitosan + absorbitol 900 mg	USA
Solaray super citrimax 750mg 60t garcinia cambogia	750 mg HCA garcinia cambogia 60% HCA	USA
Solgar chromium picolinate 100ug 90tabs	Chromium picolinate 100 mcg	USA
Solgar cla tonalin 1300mg 60 softgels 1250mg	CLA 1300 mg	USA
Tealine 40 caps (arko)	Green tea extract	France
The vert (30tabs) elusanes	Green tea extract 200 mg	France
Thermoshock	Thermo Stim Energy Reactor (387mg), Well Being Adaptogen System (240mg), Appetite Suppressing and Metabolism Accelerator (30.2mg), and the Delivery Supporting Agents (15mg)	
Triveplex 84 gelules -1 mois ventre plat nhco	4 capsules: Green tea 300 mg, guarana 180 mg, choline bitartrate 150 mg, dandelion 60 mg, cherry stems 60 mg, FOS 100 mg, green clay 100 mg, fennel 70 mg, vegetable charcoal 40 mg, angelica 70 mg, 6 strains of Lactobacillus and bifidobacteria 44 mg, L-arginine HCl 300 mg, L-glutamine 180 mg, Zinc 10 mg, vitamin B6 1.4 mg, chromium 25 mcg	France
Trio slim	Green coffee beans acai berry	Lebanon
Turbo slim	green tea, zinc, chromium, wakame, beriketon	
Forte Pharma 56 capsules		France
Via ananas	Pineapple extract (bromelain)	Lebanon
Via 3 jours express 3 x 6 tabs	Morning tablets: calcium carbonate, guarana extract, fucus extract, vitamin C Noon tablets: spirulina, apple pectin, fennel extract, gentian extract, cherry stem extract, artichoke Evening tablets: Christ marine, green teat extract, elderberry extract, L carnitine	

Viaslim 30 capsules	Apple vinegar 110mg, lotus leaf 90mg, aloe vera extract 60mg, ginseng 50mg, dried ginger 40mg, fiber 40mg, mulberry leaves 40mg, licorice 35mg, poria cocos 35mg	China
Zuccarin 60 tablets	3 tablets: Mulberry leaf extract (Morus alba L.) 1200 mg, chromium 20 mcg.	Sweden

**Table 4: Distribution of participants by their sociodemographic data (n=200)**

<b>Variables</b>	<b>Non Users of weight loss supplements (N=100)</b>	<b>Users of weight loss supplements (N=100)</b>	<b>Test statistic</b>	<b>P-value</b>
	<b>Frequency (%)</b>	<b>Frequency (%)</b>		
<b>Age</b>			$\chi^2 = 13.11$	<b>0.001</b>
18-24	18 (18%)	3 (3%)		
25-44	57 (57%)	60 (60%)		
≥ 45	25 (25%)	37 (37%)		
<b>Gender</b>			$\chi^2 = 5.78$	<b>0.016</b>
Male	34 (34%)	19 (19%)		
Female	66 (66%)	81 (81%)		
<b>Marital status</b>			$\chi^2 = 12.32$	<b>0.006</b>
Married	64 (64%)	84 (84%)		
Single	32 (32%)	12 (12%)		
Divorced	2 (2%)	3 (3%)		
Widowed	2 (2%)	1 (1%)		
<b>Occupation</b>			$\chi^2 = 24.87$	<b>&lt;0.001</b>
Student	15 (15%)	1 (1%)		
Self-employed	11 (11%)	21 (21%)		
Employee	62 (62%)	48 (48%)		
House wife/ retired	12 (12%)	30 (30%)		
<b>Place of residence</b>				
Mount Lebanon	92 (92%)	98 (98%)		
Other	8 (8%)	2 (2%)		
<b>Monthly income</b>			$\chi^2 = 2.84$	<b>0.417</b>
Below 1500000	46 (46%)	49 (49.5%)		
1500000-2999999	40 (40%)	40 (40.4%)		
3000000-4500000	11 (11%)	5 (5.1%)		
Above 4500000	3 (3%)	5 (5.1%)		
<b>Level of education</b>			$\chi^2 = 12.77$	<b>0.012</b>
Complimentary level	8 (8%)	18 (18%)		
High school	22 (22%)	34 (34%)		
Bachelor	54 (54%)	42 (42%)		
Master/ Doctorate	16 (16%)	6 (6%)		

**Table 5: Health determinants of participants (n=200)**

<b>Variables</b>	<b>Non Users of weight loss supplements (N=100)</b>	<b>Users of weight loss supplements (N=100)</b>	<b>Test statistic</b>	<b>P-value</b>
	<b>Frequency (%)</b>	<b>Frequency (%)</b>		
<b>Weight range</b>			$\chi^2=4.71$	0.194
Underweight	1 (1%)	0		
Normal	53 (53%)	40 (40%)		
Overweight	29 (29%)	39 (39%)		
Obese	17 (17%)	21 (21%)		
<b>Chronic diseases*</b>				
Diabetes	9 (9%)	4 (4%)	$\chi^2=2.06$	0.152
Dyslipidemia	10 (10%)	9 (9%)	$\chi^2=0.06$	0.809
Cardiac diseases	3 (3%)	0 (0%)	$\chi^2=3.05$	0.081
Hypertension	13 (13%)	11 (11%)	$\chi^2=0.19$	0.663
Thyroid disease	3 (3%)	11 (11%)	$\chi^2=4.92$	<b>0.027</b>
Other diseases	12 (12%)	8 (8%)	$\chi^2=0.89$	0.346
<b>Use of chronic medications</b>			$\chi^2=0.01$	0.922
No	66 (67.3%)	68 (68%)		
Yes	32 (32.7%)	32 (32%)		
<b>Smoking</b>			$\chi^2=19.1$	<b>&lt;0.001</b>
No	77 (77%)	47 (47%)		
Yes	23 (23%)	53 (53%)		
<b>Cigarette smoking intensity</b>			$\chi^2=2.54$	0.281
Light smokers	13 (81.3%)	19 (67.9%)		
Intermediate smokers	1 (6.3%)	7 (25%)		
Heavy smokers	2 (12.5%)	2 (7.1%)		
<b>SCOFF</b>			$\chi^2=5.52$	<b>0.019</b>
Negative	79 (79%)	64 (64%)		
Positive	21 (21%)	36 (36%)		

**Table 6: Weight loss methods and attempts of participants (n=200)**

Variables	Non Users of weight loss supplements	Users of weight loss supplements	Test statistic	P-value
	Frequency (%)	Frequency (%)		
<b>Number of attempts to lose weight</b>			$\chi^2=38.00$	<b>&lt;0.001</b>
0	30 (30%)	0		
1-2 times	37 (37%)	35 (35%)		
3-4 times	11 (11%)	18 (18%)		
More than 4 times	22 (22%)	47 (47%)		
<b>Methods used to lose weight<sup>a</sup></b>				
Behavioral therapy	3 (4.3%)	2 (2%)	$\chi^2=0.73$	0.392
Surgery	4 (5.7%)	2 (2%)	$\chi^2=1.63$	0.201
Specific diet	40 (40.4%)	57 (57.6%)	$\chi^2=5.84$	<b>0.016</b>
Medications*				
Orlistat	10 (10%)	25 (25%)	$\chi^2=7.79$	<b>0.004</b>
Metformin	13 (13%)	8 (8%)	$\chi^2=1.33$	0.249
Liraglutide	1 (1%)	3 (3%)	$\chi^2=1.02$	0.312
Physical activity	45 (45%)	50 (50%)	$\chi^2=0.50$	0.479
Alternative medicine	1 (1%)	8 (8%)		
<b>Lost weight with medications</b>			$\chi^2=1.60$	0.206
No	9 (39.1%)	17 (56.7%)		
Yes	14 (60.9%)	13 (43.3%)		
<b>Diet recommended by</b>			$\chi^2=4.61$	0.203
Dietician	30 (75%)	46 (83.6%)		
Medical doctor	4 (10%)	1 (1.8%)		
Self-recommendation	5 (12.5%)	8 (14.5%)		
Friend	1 (2.5%)			
<b>Types of diet used*</b>				
Protein diet	7 (21.2%)	19 (38.8%)	$\chi^2=2.81$	0.094
Diet meals	1 (3%)	1 (2%)	$\chi^2=0.08$	0.776
Regulation of meals	13 (39.4%)	19 (38%)	$\chi^2=0.01$	0.898
Low carb	9 (27.3%)	10 (20.4%)	$\chi^2=0.52$	0.470
Gluten free	1 (3%)	1 (2%)	$\chi^2=0.08$	0.776
Detox	2 (6.1%)		$\chi^2=3.04$	0.081
Very low calorie diet	2 (6.1%)	1 (2%)	$\chi^2=0.90$	0.342

**Table 7: Users of weight loss supplements (n=100)**

<b>Variables</b>	<b>Frequency (%)</b>
<b>Sources of weight loss supplements*<sup>β</sup></b>	
Online shopping	4 (4%)
Pharmacy	87 (87%)
Other	11 (11%)
<b>Informed doctor</b>	
No	95 (95%)
Yes	5 (5%)
<b>Weight Loss supplements used*</b>	
ABslim	48 (48%)
Clarinol	12 (12%)
Mincidetox	11 (11%)
Liporedux	6 (6%)
Via slim	6 (6%)
Bruler les graisses aqua ligne	5 (5%)
Zein el atet	5 (5%)
Unknown	5 (5%)
Reduire l'appetit vitarmonyl	3 (3%)
L'organica	3 (3%)
Zuccarin	3 (3%)
Kalory diur	3 (3%)
Lipoxit	3 (3%)
Advancis fat blocker	1 (1%)
Herbalife	1 (1%)
Terrafort ventre plat	1 (1%)
L carnitine	1 (1%)
Magrim diet	1 (1%)
Mxl blueberry	1 (1%)
Garcinia cambogia sundown	1 (1%)
Lypotrol	1 (1%)
Clenbuterol	1 (1%)
<b>Duration of use</b>	
Less than 30 days	44 (45.8%)
30 to 90 days	30 (31.3%)
More than 90 days	22 (22.9%)
<b>Did you lose weight after using the supplement</b>	
No	37 (37%)
Yes	63 (63%)
<b>Weight lost with supplement use</b>	
1-5 kg	49 (77.8%)
6-10 kg	6 (9.5%)

More than 10 kg	8 (12.7%)
<b>Supplement recommended by *</b>	
Pharmacist	40 (40%)
Physician	2 (2%)
Dietician	6 (6%)
Media	13 (13%)
Friend	45 (45%)
Fitness trainer	2 (2%)
<b>Perception of mechanism of action*</b>	
Detox	10 (10%)
Fluid drainer	5 (5%)
Fat burner	57 (57%)
Appetite suppressant	47 (47%)
Decreases sugar absorption	5 (5%)
Other mechanisms	1 (1%)
<b>Purpose of use*</b>	
Rapid weight loss	95 (95%)
Aid to exercise	69 (69%)
Frustration after many attempts	49 (49%)
<b>Side effects noticed by the participants</b>	
No	41 (41%)
Yes	59 (59%)
<b>Types of side effects*</b>	
Headaches	24 (40.7%)
Sleeping disorders	18 (30.5%)
Nausea	16 (27.1%)
Respiratory disorders	14 (23.7%)
Palpitations	13 (22.0%)
Constipation	8 (13.6%)
Diarrhea	7 (11.9%)
Abdominal pain	5 (8.5%)
Nervousness	4 (6.7%)
Dry mouth	2 (3.4%)
Feeling uncomfortable	2 (3.4%)
Psychic disorders	2 (3.4%)
Rise in blood pressure	2 (3.4%)
Urinary problems	2 (3.4%)
Other side effects	8 (13.6%)

\* Multiple Choice Question Total not equal to 100%

<sup>ß</sup> Please refer to table 3 for the composition of every supplement

**Table 8: Users and non-users beliefs about weight and weight loss supplements**

Variables	Non User of weight loss supplements (N=100)	User of weight loss supplements (N=100)	Test statistic	P-value
	Frequency (%)	Frequency (%)		
I believe my weight is normal	62 (62%)	43 (43%)	$\chi^2=7.24$	0.007
I believe my weight is over	38 (38%)	57 (57%)	$\chi^2=7.23$	0.007
I believe herbal supplements are safer than drugs for weight loss			$\chi^2=17.53$	<0.001
No	43 (43%)	16 (16%)		
Yes	57 (57%)	84 (84%)		
I believe weight loss supplements are safe	16 (16%)	39 (39%)	$\chi^2=13.27$	<0.001
I believe weight loss supplements are not efficient	88 (88%)	60 (60%)	$\chi^2=20.37$	<0.001
I do not know enough about them	90 (90%)	83 (83%)	$\chi^2=2.10$	0.147
I believe weight loss supplements are expensive	94 (94%)	67 (67%)	$\chi^2=23.22$	<0.001