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REVIEW ARTICLE

# Medicinal Plants Against Obesity: A Met-Analysis of Literature.

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## ABSTRACT

Obesity is a universal disease, which leads to negative effects in society and at the individual human's health. It is caused by several factors and the synergy of many different mechanisms of action. There are some therapeutic approaches, which scientists have promoted for obesity. One of these approaches is the use of natural herbal products against obesity. In the present literature study, a meta-analysis was conducted of the results of numerous original studies, which examine natural herbal products against obesity. The outcomes of this met-analysis present the most popular families of herbs and their including species which are used for the reduction of the obesity. Moreover, the present study refers the main mechanisms of action of these plant products. Finally, the most common parts of plants, which were used for their anti-obesity actions, are present. The results show that Lamiaceae and Rosaceae were the most examined families against obesity, which contained metabolites such as phenolic acids and polyphenols. Finally, the literature review shows that most of the times researchers had tested the combination of different mechanism of actions; which the most popular mechanisms refer were the inhibition of pancreatic lipase and ketohexinase-C.

KEYWORDS:
anti-obesity, Lamiaceae, natural products, herbal parts, pancreatic lipase

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## INTRODUCTION

Obesity is a modern worldwide pandemic disease, which affects people all over the world and at any age. It is important to note, that 10% of planet's adult population are overweight. Obesity developed by the uncontrolled accumulation of fat, which leads to an increase in body weight and it is responsible for the cause of many illnesses. This disease has adverse effects on the patient's social, economic and psychological state.

Obesity is a complex disease. It is a result of the combination of several different factors. These are the interaction of genetic and environmental factors, psychosomatic diseases (such as depression and hypothyroidism), some categories of mediations (for example thyroid medications), the modern Lifestyle, dietary factors, the smoking and the presence of infectious agents (mainly viruses), which are able to affect human metabolism. In addition, obesity becomes by the synergy of many mechanisms in the metabolism of lipids. These mechanisms of the body are divided into two categories: peripheral actions (for example the action of pancreatic lipase) and central actions (e.g. the inhibition of serotonin).

For these reasons, numerous of therapeutic approaches have been proposed. These are categorized at non-invasive methods, which are the physical exercise and the change in daily lifestyle and diet, and invasive methods, that are pharmacotherapy and surgical actions. Unfortunately, the treatment or the control of this disease is not always achieved. So, it is necessary to discover new therapeutic methods against obesity. One interesting approach is the examination of natural herbal products, which are one or more chemicals, which are substance of the whole or a part or an extract of a plant. Positive facts of this approach are, that are economic, easy to buy them, safe (no toxic), effective and can have a variety of mechanisms against the obesity.

The study of a variety of mechanisms acting against obesity is very important, because obesity is a complex decease, which is a result of the synergy of many body mechanisms. If any research findings shows a plant species, which can strike against more obesity's targets than one, then this herb probably is ideal for obesity's treatment. Moreover, there are other important mechanisms of plant's substance actions against this disease, such as the inhibition of pancreatic lipase, ketohexinase-C, Diacylglyceride acyltransferase 1 (DGAT1) and finally the antioxidant action. More specifically, pancreatic lipase is an enzyme, that hydrolyzes most of the fatty acids, and its inhibition stops this procedure, so the patient is not able to store fat. In addition, ketohexinase-C is an enzyme, which is responsible for the metabolism of the fructose. The enzyme's inhibition prevents fructose metabolism and therefore, organism avoids fructose's side effects. Moreover, DGAT1 is an intestinal enzyme, which is essential for the synthesis of triglycerides. Its inhibition stops this synthetic process and there are not triglycerides, which provide obesity. Finally, an antioxidant action prevents the body to oxidize fatty acids, whose accumulation leads to the development of obesity.

It is important to collect and analyze all the new information about the use of herbal products against obesity. To that target; the present study proceed to the collection and the analysis of several original papers refer to the use of natural herbal products against obesity. In addition, this information must be re-organized and put out an outcome, so a meta-analysis was done. The aim of this analysis was to present the most popular examined plant families, the parts of plants and the mechanisms of action, in which the global research community has focused its attention.

## MATERIALS AND METHODS

For this purpose, scientific articles' research became through Scopus and Science Direct web databases. All papers, which selected for further analysis in the present short communication, were following certain criteria. These were articles, that were written in English, referred to products derived from terrestrial plants, which their Latin name was listed, and analyzed the mechanism of action of herbal products against the obesity. Moreover, selected papers, which did not publish before 2014, were not review articles and papers with non-free access articles to their full text. After the research, a meta-analysis of the final 24 scientific articles was done.

## RESULTS

This meta-analysis produced table 1, table 2 and figure 1. (Table 1 near here).

Table 1 presents the plant's families, which are found during the research of the articles. Additionally, this table shows accurate families' species number and their percentage of the total number of species. The more referred families are Lamiaceae (25.49%), Rosaceae (10.78%), Apiaceae (7.84%), Compositae (5.88%) and Leguminosae (4.90%). (Figure 1 near here).

Figure 1 is a statistical pie, which informs for the percentage of the various parts of plants, which are examined by scientific articles. Fruits (26%), leaves (25%) and aerial parts (22%) are tested more from herbal species. (Table 2 near here).

Table 2 gives results about the most popular mechanism of action of herbal products against obesity. The main result is the combination of action and the inhibition of pancreatic lipase with percentage of 32.6%, each other, and the inhibition of ketohexinase-C with percentage of 16.3%.

The aftermath of tables 1, 2 and figure 1 is to show, that herbs, which used as foods, and many and different mechanisms, which combines their actions, were studied more by the international literature.

**Table 1:** Families with their number of plants species and their percentage in compare of the total number of species.

| A/A | Family | No. Species | % |
|---|---|---|---|
| 1 | Lamiaceae | 26 | 25,49 |
| 2 | Rosaceae | 11 | 10,78 |
| 3 | Apiaceae | 8 | 7,84 |
| 4 | Compositae | 6 | 5,88 |
| 5 | Leguminosae | 5 | 4,90 |
| 6 | Araliaceae | 3 | 2,94 |
| 7 | Brassicaceae | 3 | 2,94 |
| 8 | Rutaceae | 3 | 2,94 |
| 9 | Amaryllidaceae | 2 | 1,96 |
| 10 | Anacardiaceae | 2 | 1,96 |
| 11 | Cucurbitaceae | 2 | 1,96 |
| 12 | Lauraceae | 2 | 1,96 |
| 13 | Zingiberaceae | 2 | 1,96 |
| 14 | Other | 27 | 26,47 |
| | TOTAL | 102 | |

**Table 2:** Percentage of plants' constituents' mechanism of actions.

| A/A | Mechanism of action | % |
|---|---|---|
| 1 | Antioxidant action | 9,3 |
| 2 | inhibition of DGAT1 | 9,3 |
| 3 | inhibition of ketohexinase-C | 16,3 |
| 4 | inhibition of pancreatic lipase | 32,6 |
| 5 | combination of actions | 32,6 |

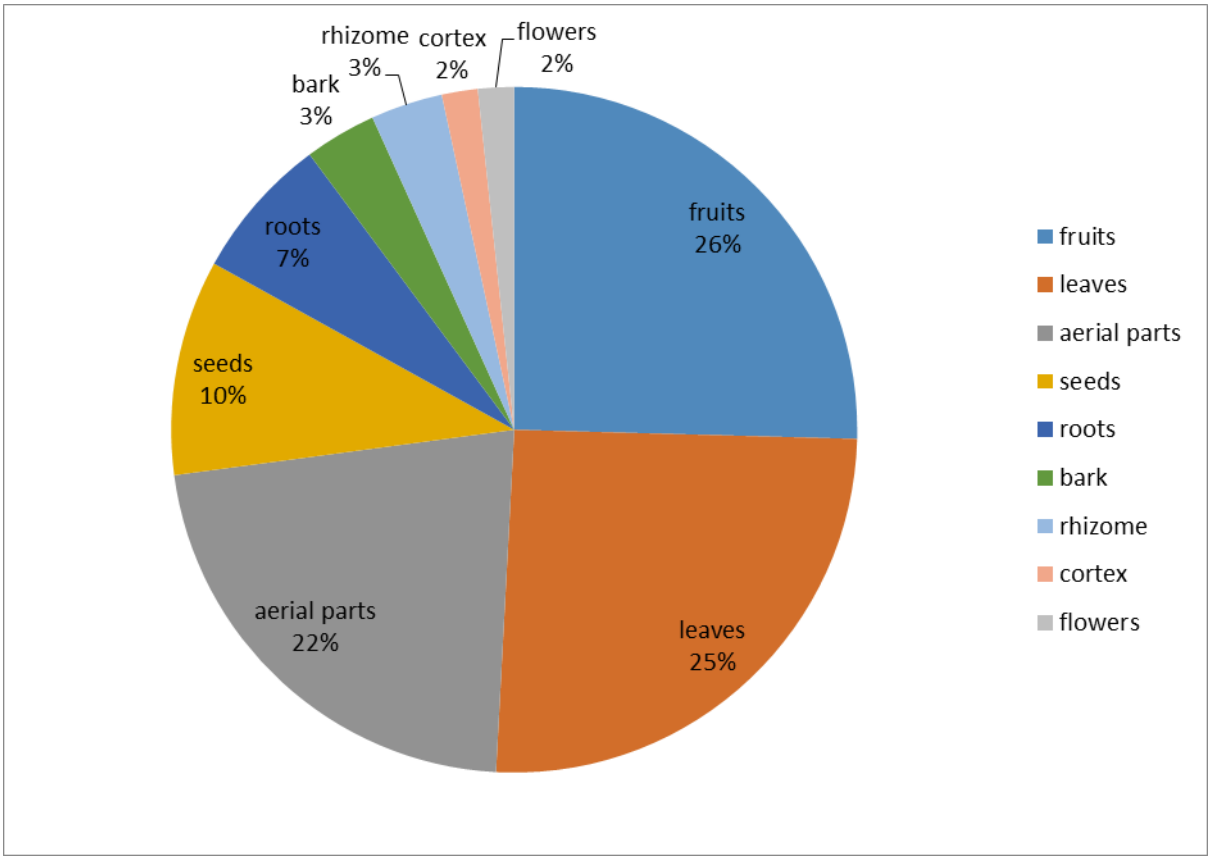


**Fig.1:** Statistical pie presenting the percentage of the various parts of herbals.

## DISCUSSION

Initially, Table 1 presents the most referred families, which are Lamiaceae (e.g. Salvia officinalis or Rosmarinus officinalis) (Xie et al. 2016, Khedher et. al. 2018 and Pereira et. al. 2018), Rosaceae (e.g. Mallus domestica) (Velliquette et. al. 2015, Lee et. al. 2016 and Bounihi et. al. 2017), Apiaceae (e.g. Petroselinum crispum) (Lee et. al. 2016), Compositae (e.g. Cynara scolymus) and Leguminosae (e.g. Cassia senna) (Jamous et. al. 2018). Specifically, researchers test more species and more times of these families than the others do. These targeting is logic, because these herbs are used in their majority as victuals (www.sciencedirect.com). In other words, Lamiaceae are aromatic plants, for instance the sage (www.sciencedirect.com), in Rosaceae family belongs some fruits like apple and strawberry (www.sciencedirect.com, https://www.britannica.com) and Apiaceae has many plants, which are condiments or vegetables, for example celery and carrots (www.sciencedirect.com). Moreover, at Compositae or Asteraceae family belong plants, which used for tea or drinks, for instance chamomile and Leguminosae or Fabaceae are legumes fruits, such as lentils (www.sciencedirect.com). Therefore, whatever can be eaten is easier to be taken by the obesity man and as a result, scientific community targets these plants to find any active ingredient.

Figure 1 shows the most examined parts of plants, which are fruits, leaves and aerial parts (fruits, leaves and branches). The upper organs of a plant take part to a numerous of chemical processes, such as photosynthesis (Vogelmann and Gorton 2014). These processes need a numerous of substances, like phenolic acids and polyphenols, to be happened (Kauffman et. al. 2007). Also, these substances have a key part to the control and the treatment of obesity, so scientific labs look among these parts of plants for finding an active ingredient (Velliquette et. al. 2015).

Finally yet importantly, Table 2 gives information about the mechanism of action, which are under the researching. This table shows that the two less examined mechanisms are the inhibition of DGAT1 and the antioxidant action. The inhibition of the enzyme DGAT1 seems to be important against obesity

but still today, its actions are under investications (Velliquette et. al. 2015). On the other hand, many scientific articles (Bounihi et. al. 2017, Jamous et. al. 2018, Khabeer, Prashant & Krishnan 2019, Kim et. al. 2018, Park et. al. 2019a, Pereira et. al. 2018) mention the antioxidant action as an important mechanism of action against obesity. Despite this, antioxidant action seems is usually examined in parallel with other mechanisms (e.g. inhibition of pancreatic lipase). Too popular mechanisms are the inhibitions of pancreatic lipase and ketohexinase-C enzymes, which are important enzymes for lipogenetic procedures and their inhibition not only by terminating lipogenesis, but sometimes activating lipolysis (Fei et. al. 2016, Irondi et. al. 2016, Lee et. al. 2016, Jamous et. al. 2018 and Szczuka et. al. 2019). Moreover, the other most famous mechanism of action is not one specific mechanism, but a combination of actions. For instance, the scientific article of Irondi et al., 2016, tested the extracts of Ocimum basilicum (basil) and Ocimum gratissimum (wild basil) for their inhibitory action against pancreatic lipase and angiotensin converting enzyme 1 (ACE-1). The examination of combination of actions is important, because the development of obesity is a result of different actions in the human organism (Harvey and Champe 2007) and so that substances, which act against different targets, are better that one-target substance. Consequently, the examination may have better results.

## CONCLUSION

The hypothesis of this article was succeeded, because whole paper presents the most popular examined plant families, parts of plants and mechanisms of action, which had be researched. In other words, the research showed, that scientists focused their attention to herbs and their parts, that are able to be used as food products (e.g. fruits, vegetables and powders), and to combinations of mechanisms of action. Edible plants and their parts are easier to be taken by an obesity man, so researches want to find ingredients that can be used as a therapeutic procedure against obesity. Moreover, Scientist studied the combination of action against obesity, because the obesity is a disease, which is became by the synergy of many mechanisms. Therefore, it is better to have one therapeutic procedure that heals more than one therapeutic target. All these show the trends of the global research community about the research on this field. Articles, like this, can help new researches in the field of medicinal plants to see the results, that had exported, and to examine new plants or the same plants with different ways. Consequently, the science will have progress and people can research and find new therapeutic plants or sources against obesity.

## CONFLICT OF INTEREST

Authors declare no potential conflict of interest.

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