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Effect of a Dietary Fiber-Rich Diet Associated with Physical Activity on Lipid Parameters, Resistin and Ghrelin in a Group of Obese Men

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ABSTRACT

OBJECTIVES: The aim of our study was to investigate the effect of diet rich in dietary fiber on anthropometric, hormonal (ghrelin and resistin) and lipid parameters in a group of obese men. METHOD: This trial was performed on 50 obese men (mean age, 48±8). Serum level of insulin was measured by chemical methods while ghrelin by RIA kit, resistin levels were measured using an ELISA, insulin resistance was assessed using HOMA-IR index. All patients were recruited from the National Institute of Nutrition and Food Technology of Tunis. RESULTS: Insulin, HOMA-IR and resistin levels were significantly reduced in obese men after Fiber intake. Ghrelin was significantly increased. Ghrelin was negatively correlated with fasting blood glucose, BMI, Insulin, HOMA-IR and resistin. Resistin was positively correlated with Fasting blood glucose, BMI, Insulin and HOMA-IR. After fiber intake, dietary fiber was significantly and positively correlated with HDL-C and Ghrelin. In addition, negative correlations were found between dietary fiber and BMI, Insulin, resistin, ghrelin. Conclusion: The present study approves the benefits of fiber intake in obese subjects and demonstrates the effectiveness of the combination of a balanced diet and physical activity for better health without complications and co-morbidities. It is therefore important to promote diets rich in plant-based foods to ensure the recommended fiber intakes.

INTRODUCTION:

Obesity is a major risk factor for insulin resistance, type 2 diabetes, heart disease, orthopedic problems, and many other chronic diseases. The incidence of obesity has dramatically increased and has become epidemic in the western world (1). Obesity is the final consequence of a chronic positive energy balance, regulated by a complex network between endocrine tissues and the central nervous system. (2,3) Adipose tissue is an active endocrine organ with a high metabolic activity. Adipocytes secrete several proteins that act as veritable hormones, responsible for the regulation of energy intake and expenditure (4).

Resistin is a new adipocytokine and mainly secreted by adipose tissue and peripheral mononuclear blood cells in human (5). In humans, the physiological role of resistin is far from clear and its role in obesity and insulin resistance and/or diabetes is controversial. In humans, as resistin is primarily produced in peripheral blood monocytes and its levels correlate with IL-6 concentrations, the question of its inflammatory role has been raised. (6,7)

The peptide ghrelin circulates in blood and participates in energy homeostasis and regulation of body weight (8). Ghrelin is a 28-amino acid peptide derived from pre-proghrelin. It undergoes post-translational modification in which the serine-3 residue is covalently linked to octanoic acid. This post-translational acylation is unique to ghrelin and is necessary for ghrelin to bind to the growth hormone secretagogue receptor (GHS-R1a) and to cross the blood-brain barrier and seems to have importance for its endocrine actions, but the unacylated form has also been shown to possess metabolic effects (9). Ghrelin plays a role in the longer-term regulation of body weight and energy homeostasis, in humans circulating ghrelin levels are inversely correlated to the degree of adiposity, with low levels in obese subjects (10).

The purpose of this study was to investigate the effect of a dietary fiber-rich diet associated with physical activity on lipid parameters, resistin and ghrelin in a group of obese men.

Dietary fiber intake provides many health benefits. A generous intake of dietary fiber reduces risk for developing the following diseases: coronary heart disease (11) stroke (12) Hypertension (13). Diabetes(14) obesity (15) and certain gastrointestinal disorders (16). Furthermore, increased consumption of dietary fiber improves serum lipid concentrations, (17)lowers blood pressure,(18) improves blood glucose control in diabetes,(19) promotes regularity, (20) aids in weight loss,(21) and appears to improve immune function. (22)

According to the ADA (American Dietetic Association), a consumption of 14g/1000kcal of dietary fiber or the equivalent of 25g for adult women and 38g for adult men provides protection against cardiovascular disease **(23).** The Canadian Diabetes Association recommends up to 50 grams of daily fiber intake **(**24,25**).**

Soluble and viscous fibers delay gastric emptying and prolong the transit time of the intestinal contents, which improves the interaction between Nutrients and cells that release hormones from satiety(26).

Another possible mechanism for increasing satiety is the fermentation of fibers by the intestinal microflora which induces the production of short chain fatty acids (AGCC). These AGCCs interact with the coupled G-protein receptors such as GPR41 and GPR43 endocrine cells thereby increasing the production of hormones related to satiety **(**27**).**

Physical activity is defined as any movement of the body produced by the contraction of the skeletal muscles raising the energy expenditure above the basal level.

Physical activity includes all movements in daily life, not just sport. The main characteristics of a given physical activity are the intensity, duration, frequency, and context in which it is practiced (28).

The most recent recommendations for maintaining and promoting health for the general population (adults up to age 65) emphasize the practice of a minimum of 30 minutes of moderate-intensity physical activity per day, 5 days a week.

The practice of 20 minutes of high intensity activity 3 times per week is given as equivalence (29).

Indeed, exercise constitutes an increase in the demand for fatty acids as a muscle energy substrate and induces an increase in the adrenergic tone. These two stimuli induce lipolysis within adipose tissue (30). Increasing physical activity without reducing energy intake has a modest effect on weight loss.

Multiple beneficial effects of physical activity have been described, whether physiological or psychological: conservation of lean mass, mobilization of visceral adipose tissue, increased mobilization and oxidation of lipids, improved control of lappetite, favorable metabolic effects on insulin sensitivity, glycemic control or plasma lipid profile, not to mention self-esteem or feeling of well-being.

The interest of physical activity is, therefore, immense for the prevention of certain diseases related to obesity, such as diabetes, hypertension, dyslipidemias and probably certain types of cancer (30;31).

MATERIALS AND METHODS:

Participants and procedures: This clinical Trial was performed at the National Institute of Nutrition and Food Technology of Tunisia. Between October 2010 and April 2011. Fifty (50) obese men were recruited, with no history of vascular disease, with normal ECG findings at exercise and normal peripheral artery doppler ultrasonography findings. The exclusion criteria were the presence of sustained type 1 diabetes, type 2 diabetes, acute and chronic infections, malignancy, hepatic or renal disease, diabetic retinopathy, and other endocrine dysfunctions. None of the subjects had received any medication (hormone therapy, corticosteroids, antioxidant formulations and thiazolidinediones) which may have affected insulin resistance and/or endothelial function and none of the subjects were current smokers and consumers of alcohol. Patients belonged to the same ethnic background and all shared a common geographic origin in North Tunisia. The research protocol was approved by the local ethics committee and informed written consent was obtained from each subject. Weight and height were measured on the subjects barefooted and lightly clothed. All patients involved in the study agreed to participate voluntarily in our survey and expressed a serious interest in losing weight.

All participants provided signed consent and personal information was kept as confidential.

Measures and collecting data: Questionnaires regarding medical history, physical activity and dietary habits were collected at baseline.

1. General characteristics of the respondent: age, marital status, educational attainment, socio-economic status, occupation. 2. Possible disorders of eating behavior (snacking, bulimia) as well as the frequency of consumption of foods at risk such as fatty and sugary

foods. 3. The usual types and levels of physical activity practiced by the respondent, trying to evaluate the duration, rhythmicity of the daily walk.

Anthropometric assessments: Anthropometric indices included height, body weight, and waist circumference. Standing height was measured without shoes using a calibrated stadiometer (down to 0.5 cm); while body weight was measured in light clothes using a calibrated digital scale (down to 10 g). Body mass index (BMI) was calculated as weight (kg)/height $(m)^2$. The waist circumference was measured at the smallest circumference at or below the costal margin. All the anthropometric measurements were performed at each appointment with the patient who was set on average every 15 days. A food survey was conducted based on the 24-hour recall method and food history.

Management of patients : Our protocol for the management of obese men is essentially based on strict supervision and follow-up by a Dietician and a doctor, this protocol consists of a prescription of a personalized diet: Following the results of the nutritional survey, each patient is subjected to a diet characterized by a decrease of one third of the spontaneous caloric intake, an increased consumption of foods based on low glycemic index fibers, vegetables and seasonal fruits, and the practice of daily walking of 60 minutes. Each patient was monitored every 15 days at the outpatient clinic to help them overcome the protocol follow-up difficulties.

Metabolic assessment: After a 12 h overnight fast, samples were drawn from the patients and controls between 7.00 and 9.00 a.m. via the venipuncture of an antecubital vein. Blood samples were collected in vacutainer tubes with a gel separator and in heparinized tubes and were centrifuged at 2000 rpm for 15 min at 4°C. All biochemical variables were measured on the same day of the blood collection and a 1-ml aliquot of plasma was rapidly frozen (-20°C) for subsequent blood biochemical analysis.

Total cholesterol (TC), HDL-Cholesterol (HDL-C), triglyceride (TG) were measured by an enzymatic colorimetric method. Insulin levels were measured by chemiluminescence immunoassay method. The fasting plasma glucose was determined with the glucose oxidase enzymatic method (Beckman Synchron Cx9). Blood pressure was measured using a mercury sphygmomanometer.

Resistin levels were measured using an ELISA (CAT. #EZHR-95K Millipore (6 Research

Park Drive, St. Charles, Missouri 63304 USA)) with sensitivity 0.16 ng/mL, with Inter-assay 7.1–7.7% and Intra-assay: 3.2–7.0%.

Low density lipoprotein-cholesterol (LDL-C) was calculated using the Friedwald formula. Active ghrelin concentration was measured by Radioimmunoassay (Cat. N° GHRA-88k, Millipore (6 Research Park Drive, St. Charles, Missouri 63304 USA) with a sensitivity of 7,8 pg/ml). This assay utilizes ^{125}I-labeled Ghrelin and a Ghrelin antiserum to determine the level of active ghrelin in serum, plasma or tissue culture media by the double/PEG technique.

Analysis of the food survey: The survey data were coded according to the computer software "BILNUT" version 1991, to which was added a list of 235 foods and cooked dishes, specific to our country.

Statistical analyses: The data was entered using the "Excel version 2007" software and the statistical analysis using the SPSS 15 software.

- For comparison of matched series averages, we used the student t-test on matched series.

- Comparison of percentages on independent series was made by the Pearson chi-square test, and in case of nonvalidity of this one, by Fisher's exact bilateral test.

- The concordance between 2 quantitative variables was evaluated by the intra-class correlation coefficient "r". This coefficient is interpreted as follows:

- < 0,20: zero or very bad agreement
- 0,201- 0,41: poor agreement
- 0,61-0,80 : good agreement
- 0, 81 and over: very good match.

In all statistical tests, the significance threshold "p" was set to 0, 05.

RESULTS :

Table 1 shows the changes in energy intake and dietary composition at baseline and after diet in obese men. The daily energy intake and the consumption of saturated fat, polyunsaturated fat were significantly reduced in the experimental group (P<0.01, Table 1). In addition, Dietary fiber and Monounsaturated fat were significantly increased after diet (p<0.01).

After diet, we found an improvement in the nutritional profile of obese men. Indeed, there is a significant decrease in the Energy intake of an average of -1080±226,60 calories, also a decrease in the levels of cholesterol, polyunsaturated fat, and saturated fat. The dietary fiber has increased by +5,5.

Table 1: Changes in energy intake and dietary composition according to Food survey

Variables	**Obese men (n=50)** **Age (48,16±4,36)**		**Change**
	Baseline **Mean±SD**	**After diet** **Mean±SD**	
Energy Intake (Kcal/day)	3275,66 ±686,68	2194,69±460,07	1080,97±226,60
Macronutrient			
Dietary fiber (g)	19,28±3,23	24,88±4,53	5,59±5,23
Saturated fat (g)	8,145±2,45	6,10±1,83	2,03±0,61
Monounsaturated fat (g)	12,98±7,93	16,61±10,15	-3,63±2,22
Polyunsatured fat (g)	12,11±7,64	8,11±5,12	3,99±2,52
Cholesterol (g)	394,27±76,76	315,42±61,41	78,85±15,35

Table 2 shows the anthropometric, biochemical and hormonal characteristics of the participants at baseline and after diet.

After diet, there was a significant improvement in systolic and diastolic blood pressure as well as a decrease in anthropometric parameters with -5.5 ± 4kg / m2 for the BMI and -10.7 ± 6 cm for Waist circumference. In addition, fasting blood glucose, total cholesterol and triglycerides were significantly decreased after diet. Furthermore, Hormonal parameters, including Insulin, HOMA-IR and resistin levels were significantly reduced in obese men after diet (Table 2). Ghrelin was significantly increased after diet of an average (-1,55±2,21).

Table 2: Anthropometric, Biochemical and Hormonal characteristics of the participants at baseline and after diet.

Variables	Obese men (n=50)		Change
	Baseline Mean±SD	After diet Mean±SD	
Anthropometric parameters			
BMI	35,31±4,58	29,79±3,75	5,52±1,47
Waist Circumference (cm)	105,36±9,37	94,64±8,20	10,72±6,12
Blood pressure			
Systolic (mm Hg)	142,10±11,02	117,94±9,15	2,41±1,87
Diastolic (mm Hg)	89,32±4,20	81,73±3,84	7,59±0,35
Biochemical parameters			
HDL-C	0,75±0,18	0,94±0,23	-0,18±0,18
Fasting serum glucose (mg/dl)	7,51±1,29	6,34±0,97	1,17±0,75
Total cholesterol (g)	5,31±1,06	4,67±0,94	0,63±0,12
Triglycerides (g)	1,82±0,22	1,62±0,19	0,20±0,02
Hormonal parameters			
Insulin (µUI/L)	14,47±4,55	11,23±3,23	3,24±2,85
HOMA-IR	4,99±2,24	3,23±1,31	1,75±1,43
Resistin (pg/mL)	10,60±3,21	8,51±2,58	2,08±1,09
Ghrelin (pg/mL)	20,42±5,24	21,97±6,53	-1,55±2,21

The results of the correlations of ghrelin and resistin with biochemical and hormonal parameters are summarized in Table 3. After fiber intake, Ghrelin is negatively correlated with fasting blood glucose, BMI, Insulin, HOMA-IR and resistin and positively correlated with HDL-C and waist circumference. Resistin is positively correlated with Fasting blood glucose, BMI, waist circumference, Insulin and HOMA-IR.

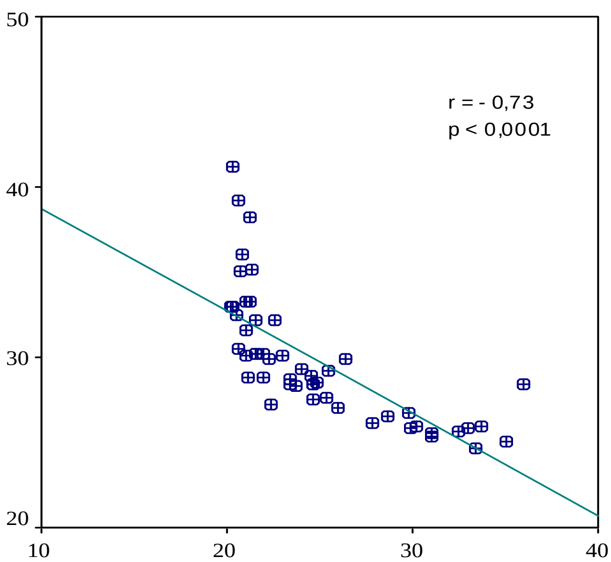
Table 3 : Correlations of ghrelin and resistin with biochemical and hormonal parameters before and after diet

Variables	Before Diet		After diet	
	r	p	r	p
Ghrelin				
Fasting blood glucose	-0,534	p<0,01	-0,485	p<0,01
HDL-C	0,415	p<0,01	0,449	p<0,01
BMI	-0,403	p<0,01	-0,489	p<0,01
Waist Circumference	0,310	p<0,01	-0,332	p<0,01
Insulin	-0, 395	p<0,01	-0,399	p<0,01
resistin	-0,382	p<0,01	-0,522	p<0,01
HOMA-IR	-0,483	p<0,01	-0,466	p<0,01
Resistin				
Fasting blood glucose	0,340	p<0,01	0,412	p<0,01
BMI	0,462	p<0,01	0,444	p<0,01
Waist circumference	0,335	p<0,01	0,415	p<0,01
Insulin	0,290	p<0,01	0,326	p<0,01
HOMA-IR	0,339	p<0,01	0,398	p<0,01

After fiber intake, dietary fiber were significantly and positively correlated with HDL-C (r=0,387 ; p<0,01, and Ghrelin (r=0,348 ; p<0,01). In addition, negative correlations were found between dietary fiber and fasting blood glucose (r=-0,510 ; p<0,01), BMI (r= -0,725 ; p<0,01), waist circumference (r=-0,306 ;p<0.01), Systolic (r=-0,322 :p<0,01), Insulin (r=-0,330 ;p<0,01), resistin (r=-0,324 ;p<0,01), ghrelin (r=0,348 ;p<0,01) and HOMA-IR (r=-0,422 ;p<0,01).

Table 4: Correlations of dietary fiber with biochemical and hormonal parameters

Variables	After Diet	
	r	**p**
Dietary Fiber		
HDL-C	0,387	p<0,01
Fasting blood glucose	-0,510	p<0,01
BMI	-0,725	p<0,01
Waist circumference	-0,306	p<0,01
Systolic (mm Hg)	-0,322	p<0,01
Insulin	-0,330	p<0,01
Resistin	-0,324	p<0,01
Ghrelin	0,348	p<0,01
HOMA-IR	-0,422	p<0,01



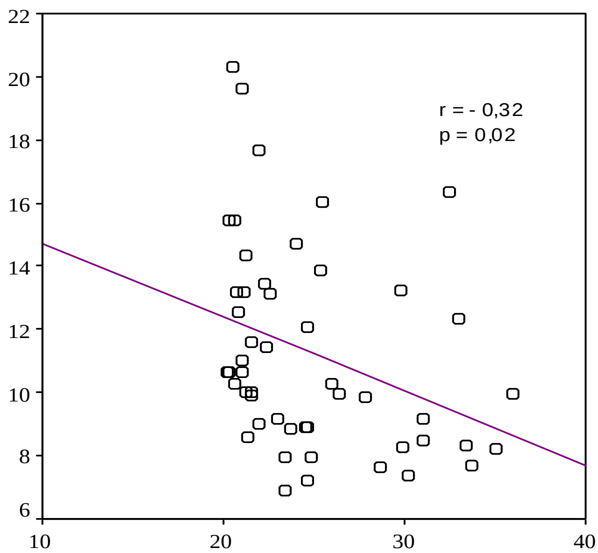
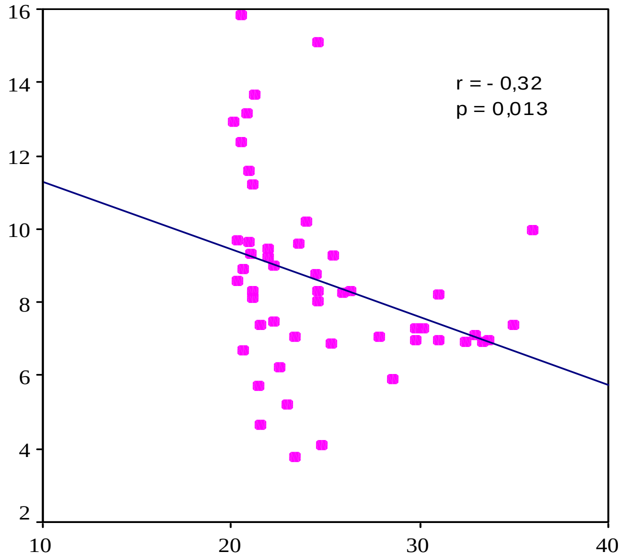


Figure 1: Correlation BMI = f (Fibers)

Figure 2: Correlation Insulin = f (Fibers)



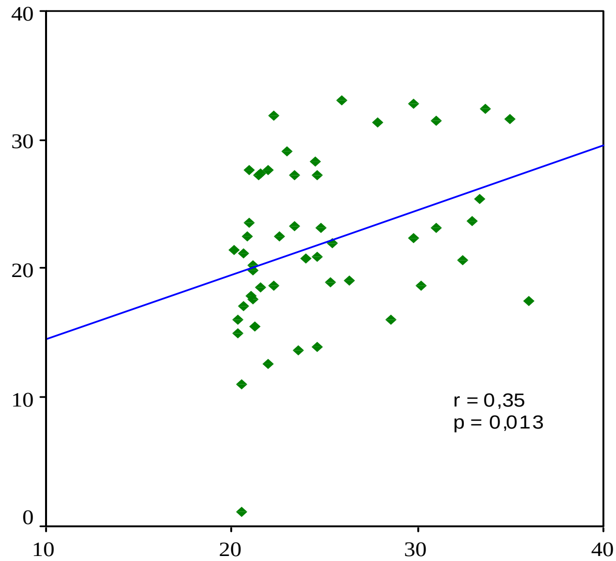


Figure 3: Correlation Resistin = f (fibers)

Figure 4: Correlation Ghrelin = f (Fibers)

DISCUSSION :

The aim of our study is to describe the effect of diet rich in dietary fiber on anthropometric, hormonal and lipid parameters in a group of obese men.

We investigated the correlations between different parameters before and after diet and also the correlations with dietary fiber levels.

Our sample population is composed of 50 obese men with an average age of 48 years.

The diet followed by patients is hypocaloric enriched in dietary fiber. Thus, our results demonstrated an increase in fiber consumption estimated to be +5.5 ± 5 g and a decrease in energy intake to approximately 1080 ± 226 calories.

We compared the anthropometric parameters before and after fiber intake, we, thus observed a good evolution of the various measures. In fact, there was a decrease in BMI, waist circumference of -5.52 ± 1.47 kg / m^2 and -10.72 ± 6.12 cm, respectively.

The correlation of dietary fiber with these parameters was significantly negative with (r = -0.725 p = 0.000) for BMI and (r = -0.306 p = 0.030) for waist circumference.

The team of Mohsen Saffari et al. has also conducted similar studies among a group of 327 obese Iranian women. Increased fiber intake ($p < 0.05$) and decreased fatty foods ($p < 0.05$) resulted in a decrease in BMI and body weight compared with the control group ($p < 0.05$) (32). They also highlighted the improvement in systolic and diastolic pressure, according to our studies in which these parameters were reduced by -2.416 ± 1.8 mmHg for PAS and -0.759 ± 0.3 mmHg for PAD ($p = 0.000$).

An investigation by Huaidong Duet al. was conducted in the Netherlands following 89 obese men and women aged 55 years and under a diet rich in cereal products, fruits and vegetables proved the same fact. They found that fiber levels were inversely related to weights and waist circumference, and concluded that fibers from cereal products produced better results than fruits and vegetables (33).

Many other studies have led to the same results as those of J. Lindström et al., (34) Newby et al. (35) Denis Lairon (36).

Reducing these numbers (BMI, TT, SAP, PAD) provides better prevention of metabolic complications and reduces the risk of cardiovascular disease.

The mechanisms by which dietary fiber helps to lower weight and waist circumference have been sought and documented by the team of Mark Pereira et al. First, foods high in fiber tend to be more filling due to their low palatability and energy density. Second, dietary fiber, especially soluble fiber, could increase the viscosity of the intestinal contents and slow digestion, which stimulates the release of hormones such as cholecystokinin and glucagon-like peptide 1 from the intestine, thus promoting satiety. In addition, dietary fiber could act as a mechanical barrier to the enzymatic digestion of other macronutrients, such as fat and starch in the small intestine. Moreover, the rate of digestion and the slower absorption of carbohydrates will lead to a reduced postprandial blood glucose response, which in the long term may improve insulin sensitivity and promote fat oxidation (37).

Concerning the glycemic balance, we have observed in our studies a decrease in the average of blood glucose after dietary fiber intake of -1.173 ± 0.75mmol / L and a decrease in the average of insulin level of -3.24 ± 28µIU / L. It should be noted that even though insulin is produced by beta-pancreatic cells, its concentration is correlated with the amount of body fat in the body and is therefore considered as an adiposity signal (38). The decrease of these two substances consequently leads to a decrease in the mean of HOMA-IR of -0.75 ± 1.43.

These three parameters are negatively and significantly correlated with the fibers (r = -0.524 ;p = 0.000) for blood glucose, (r = -0.324 p = 0.022) for insulin and (r = -0.422 ; p = 0.002) for the HOMA-IR.

These results support several studies, including the study of Breneman et al. who attempted to determine the relationship between dietary fiber intake and insulin resistance in a group of 267 adult women.

Their studies showed a significant negative correlation between soluble fiber intake and insulin resistance (39).

Cathrine Lau et al. have attempted to examine the relationship between glycemic index, daily glycemic load and dietary fiber with the development of diabetes mellitus in Danish men and women aged 30 to 60 years. They found that dietary fiber intake was inversely and significantly correlated ($p < 0.05$) with the HOMA-IR index (40).

Kartriina Ylonen et al found that high dietary fiber intake is associated with increased insulin sensitivity and thus may play a role in the prevention of type 2 diabetes (41).

Nicola M. Mc Keown et al. (42) and others confirm these results.

Dietary fiber is related to glucose metabolism through several mechanisms. First, the fibers promote control of food intake. By their physical and chemical properties, they improve satiety signals and prolong them, thus reducing total energy intake and adiposity. The beneficial effects also result from delayed gastric emptying and slowed digestion, thereby reducing the glucose level absorbed and consequently the plasma insulin levels.

In addition, fiber regulates several metabolic hormones that affect glucose metabolism. It has been shown that the improvement in glucose homeostasis observed by the high consumption of dietary fiber can be explained by the increased expression of the intestinal proglucagon gene.

Proglucagon encodes several known peptides to modulate intestinal absorption capacity and pancreatic insulin secretion (40,43).

Concerning the lipid parameters, our studies show a significant decrease after diet of total cholesterol and triglycerides with a difference of -0.6378 ± 0.12 mmol / L (p =0.000) and -

0.2006 ± 0, 02mmol / L ($p = 0.000$) with an increase in HDL-cholesterol of + 0.189 ± 0.18mmol / L ($p = 0.000$).

We also correlated these parameters with fibers: a significant positive correlation between dietary fiber and HDL cholesterol ($r = 0.387$; $p = .005$), and a negative but not significant correlation with total cholesterol and triglycerides.

These results are consistent with the study of Lisa Brown et al. They performed a meta-analysis of 67 controlled trials to quantify the cholesterol-lowering effect of dietary fiber by testing 4 types of fiber: pectin, oat bran, guar gum and psyllium. They showed a decrease in cholesterol of -0.045mmol.L-1 / g of fiber and a decrease of LDL-cholesterol of -0.057mmol.L-1 / g of fiber, with different types of fiber (44).

The team of Denis Lairon et al. explored the relationship between the type of fiber consumed and the risk factors for cardiovascular disease in a cohort of adult men and women.

Their results show that the consumption of insoluble fibers or high amounts of total fibers is significantly associated ($p < 0.05$) with the reduction in the risk of overweight, hypertension, apoB apolipoprotein elevation, TG, Cholesterol and homocysteine. Soluble fiber was less effective. They have recommended a diet rich in these fibers because of their protective role against cardiovascular diseases (45).

Jordi Salas-Salvado et al. followed for 16 weeks a group of 200 obese or overweight individuals who received three times a day a dose of 3 g of psyllium and glucomannan mixture. They demonstrated that not only these fibers improve satiety, but they also significantly decrease plasma LDL cholesterol levels (46).

The mechanisms by which fibers lower blood cholesterol are numerous. Evidence shows that some soluble fibers bind bile acids or cholesterol during intraluminal micelle formation. The resulting reduction in the cholesterol content of liver cells leads to an increase in the regulation of LDL receptors (up-regulation) and therefore an increase in the clearance of LDL cholesterol.

Other mechanisms include the inhibition of the synthesis of fatty acids produced by hepatic fermentation (production of short-chain fatty acids such as acetate, butyrate, propionate); changes in intestinal motility; High-viscosity fibers causing slower absorption of macronutrients, leading to increased insulin sensitivity; and increased satiety, leading to lower overall energy intake (47).

We also investigated the variation of deux hormones; ghrelin and resistin. The assays show that while resistin secretion regressed during the diet: -2.08 ± 1.09 ng / mL, there was an increase in ghrelin secretion of + 1.55 ± 2.21 pg / mL.

Our results demonstrated a significant negative correlation of fibers with resistin (r = -0.324 p = 0.022) and a significant positive correlation with ghrelin (r = 0.348 p = 0.013).

Studies showed that resistin, is elevated in obesity and overweight, it is positively correlated with BMI (48).

Ancha Baranova et al. Have shown that adiponectin levels are decreased in obese patients with insulin resistance compared with elevated plasma resistin concentrations (49).

These high concentrations of resistin in obese subjects are the cause of various complications including cardiovascular complications (50).

We found that after diet there was a decrease of resistin plasma levels, this decrease would result from the decrease of the adipose mass, besides BMI and resistin have negative correlations (r = 0.444; p = 0.001).

We also found an increase in ghrelin levels, which would be due to the induction of a negative energy balance (51;52).

Ghrelin has a significant negative correlation with BMI (p = -0.489; r = 0.000).

Ghrelin is also negatively correlated with resistin (r = -0.522; p=0.000) and positively correlated with HDL-C.

The team of David H St.Pierre et al. has conducted studies on 35 postmenopausal obese women with the aim of exploring the effect of dietary fiber on ghrelin secretion. They demonstrated that a high intake of fibers or polyunsaturated lipids was positively associated with an increase in ghrelin levels, with a more representative profile than healthy people (53).

The decrease of resistin and improvement in ghrelin levels shows that dietary fiber intake plays a protective role in obese subjects, however, this effect is not seen in all studies.

Samip Parikh et al. Examined combinations of dietary fiber with inflammatory biomarkers and total adiposity in 559 adolescents. They demonstrated that fiber consumption decreases visceral adiposity and lowers inflammatory biomarker levels, but the associations between fibers and resistin remain insignificant (54).

The study by Leila J. Karhunen et al. revealed that ingestion of non-caloric soluble psyllium fibers reduced ghrelin levels to levels similar to those observed after a mixed meal (55).

Joshua Tarini et al. analyzed the effect of inulin, a fermentable fiber, on the postprandial concentration of free fatty acids and ghrelin in healthy subjects. They observed an increase in the production of short chain fatty acids in the colon, which reduced the risk of type 2 diabetes and decreased ghrelin levels (56).

Thus, the association between dietary fiber and ghrelin and resistin levels is not always found. But it should be noted that these studies have investigated the immediate effect of fiber on hormones, while our target is the long-term effect. Also, there are differences in the populations studied, the methods and protocols used.

It should be added that the fibers do not all have the same efficacy, their nature and their physicochemical properties play an important role in the modifications cited (57).

Further research is needed to assess the role of dietary fiber in the management of obese subjects and to explore mechanisms for better management.

CONCLUSION:

In conclusion, the present results provide new evidence of the association of ghrelin and resistin with fiber intake in a population of obese men. Ultimately, a better understanding of the relationship between ghrelin and fiber intake may lead to new clinical strategies aimed at improving metabolic profiles.

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