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The Biological Effects of Various Grain-Based Formulas on Weight Gain in Female Rats.

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ABSTRACT:

Functional foods and alternative protein sources offer a potential opportunity to meet food needs fully. The objective of the present research was to observe the influence of extraordinary formulas of wheat germ, oatmeal, soybeans, and cocoa that could improve the body weight of female rats. A total of sixty-six female albino rats weighing 120-130g had been divided into eleven groups of six each. The first group was the control negative group, which received only a basal diet. Groups two and three received basal diet + 10 and 15% wheat germ powder. Groups four and five received basal diet + 10 and 15% oatmeal powder. Groups six and seven received basal diet + 10 and 15% soybeans powder. Groups eight and nine received basal diet + 10 and 15% cocoa powder. Groups ten and eleven received a basal diet + 10 and 15% mixture of wheat germ, oats, soybeans, and cocoa. When the experiment comes to an end (28 days), the rats will be weighed, each rat separately, and fasted for (12) hours before slaughtering them. Bodyweight gain (BWG), feed intake (FI), and feed efficiency ratio (FER) were measured. Serum samples were bought for biochemical examination and included serum glucose, liver enzymes, renal biomarkers, and lipid fraction. The findings confirmed that consuming wheat germ, oats, soybeans, and cocoa powder caused significant ($P \leq 0.05$) improvements in all biochemical analyses. In conclusion, using grains formula powder can improve the BWG of underweight.

Keywords: Functional Foods, Grains Formula, Liver Enzymes, Renal Biomarkers, Weight Gain

1. INTRODUCTION

Undernutrition is nevertheless a serious health issue even in growing nations where economic growth has been noted. Adolescent undernutrition may additionally have long-term results and would possibly interfere with appropriate growth and puberty development. A macro and micro-nutrient deficiency in the body are caused through inadequate dietary consumption, low nutrient content material of the food, and common illnesses (1). Thinness can be described clinically as the low body mass index (BMI)-for-age (2). It is linked to various harmful health outcomes, which include

insufficient nutrition, decreased kid's increase and development, intervals that are irregular in female and girls, reduced cognitive and work performance, and an expanded chance of sickness (3). In line with WHO classes based totally on underweight rates, it is indispensable to focal point on addressing each extreme of the malnutrition range. To gain the millennium objectives, adjustments in dwelling requirements and the great of foods are required (4). Traditional or common meals are categorized as functional meals due to the fact they give a vital nutritional degree and have the possibility to enhance host health. These advantages consist of lowering disorder by way of enhancing the immune system's ability to fend off infections from pathogens and illnesses that alter the host's functional state (5). Early childhood wellbeing education, which consists of encouraging a balanced food regimen and frequent exercise, can have a considerable influence on kids' health and well-being as they develop older (6).

All over the world, wheat is considerable meals crop that is grown and processed in huge amounts. Wheat germ, one of its byproducts, might also be utilized to create items with extra value. Wheat germ was once located to be an excellent supply of numerous nutritionally high-quality components, as properly as having huge health advantages and useful qualities (7). Phytochemical compounds inclusive of sterols and antioxidants exist in wheat germ. Carotenoids, phenolic compounds, and tocopherols are the major kinds of antioxidants. Certain unsaturated fatty acids, along with oleic, linoleic, and **α**-linoleic acids, are additionally present in wheat germ. Furthermore, in contrast to egg protein, almost crucial amino acids from wheat germ proteins are in greater concentrations. Additionally, 10% of wheat containing germ oil is used in the beauty and scientific fields. Regarding advantages to human health, it has been mentioned that processing wheat germ can be used in tumor therapy as properly as prevention (8).

Compared to other whole grains, oats are greater in protein, fiber, iron, and zinc. Their tasty nature and potential to stimulate bodily metabolic modifications make them a great supply of nutrients for each person and animals.

In contrast to different particularly insoluble cereals like rice or wheat, oats have been proven to be medicinally effective for hyperglycemia, obesity, vascular damage, inflammatory conditions, and hypertensive. This makes oats special amongst cereals. This learn about outlines the numerous market's availability of each ferment and non-ferment oat items emphasizes the nutritive value of oats. and discusses how **β**-glucan in products serves as an organic protection modulator and how they possibly prevent certain illnesses (9).

Since soybean products became regarded as functional foods that ought

to enhance bowel control and blood circulation, research on them has skyrocketed. Soybeans are a suitable supply of isoflavones like (genistein and daidzein), dietary fiber, phospholipids, polyphenols, and anti-nutritional factor. All such advantages are along with to its nutrients (10). The health advantages of soybeans are related with their potential to prevent and treat a wide variety of continual illnesses, along with diabetes, cancer, coronary heart disease, senile dementia, and osteoporosis. In addition, soybeans have anti-mutagenic, anti-tumor, and anti-microbial properties. They can additionally influence breakdown of fats, modulate arterial pressure, and have an impact on the activity of fibrinolytic (11).

Because of its several health advantages and excessive nutrient content, cocoa is regarded an extremely good food. Naturally going on compounds can additionally be in cocoa. Consuming the bioactive factors determined in cocoa and items made with cocoa can be a nutritious and well-rounded way to eat. Numerous health advantages are attributed to bioactive elements rich in antioxidants and anti-inflammatory properties (12).

Therefore, the purpose of this research was once to examine the consequences of several wheat germ formulations. Oats, soybeans, and cocoa on body weight.

2. Materials and methods

2.1 Materials

2.1.1 Plants

Wheat germs were obtained from Mills Company in Al-Gharbia. Oatmeal, soybeans, and cocoa seeds were obtained from herb shop, and they were grinded separately into a fine powder before adding them to the diet.

2.1.2. Experimental rats and diet

At the start of the experiment, sixty-six female albino rats weighing 120–130g had been delivered from (M.A.S.R.I.-Animal Research), Faculty of Medicine, Ain Shams University. In wire cages, every rat was housed separately in the Biological Laboratory's standard operating conditions. For a week, the rats acquired a basal diet to assist them adjust. Rats had been given a special diet using plates to stop meals infection and spillage. Additionally, glass tubes that protruded via the wire cages from an upside-down bottle positioned on one facet of the cage gave the rats entry to water. In accordance with AIN-93 standards (13), a basal diet used to be constructed with the use of great products. Every animal used to be cared for in accordance with Egyptian regulations pertaining to animal welfare.

2.1.3. Chemicals

The following was once the composition of the regular diet: protein (12%), corn oil (10%), mineral combination (4%), diet combination (1%), choline chloride (0.25%), methionine (0.3%), cellulose (5%), and corn starch (100%) as documented in reference (14). Although the salt mixture was once organized in

accordance with (15). Biochemical assay kits were obtained from the Morgan Company, in Cairo, Egypt.

2.2. Methods

2.2.1. Preparations of wheat germ, oatmeal, soybeans, and cocoa

To make the dried powdered wheat germ, oatmeal, soybeans, and cocoa, they were bought from an herbalist and beaten in an air-powered mill the usage of a high-speed blender (Broun, Germany), supplied in powder form, and then sealed in brown glass bottles and saved in a deep freezer at -18 °C till used in extra treatments.

2.2.2. Experimental protocol

The Ethics Committee of Menoufia University's Faculty of Home Economics approve study protocol #11-SREC-09-2023.

In this study, 66 female white rats weighing a common of 120–130g have been used. In this test, a basal meal used to be given to all experimental rats for a non-stop seven days, in line with (16). After the duration of adaption, the rats are divided into eleven groups, every consisting of 6 rats: Group 1 consisted of female rats that had been given a regular diet and had been used as a control negative group. Groups (2 and 3): Female rats which were received the basal diet + 10 and 15% of wheat germ powder, respectively. Groups (4 and 5): Female rats which were received the basal diet + 10 and 15% of oatmeal powder, respectively. Groups (6 and 7): Female rats which were received the basal diet + 10 and 15% of soybeans powder, respectively. Groups (8 and 9): Female rats which were received the basal diet + 10 and 15% of cocoa powder, respectively. Groups (10 and 11): Female rats which were received the basal diet + 10 and 15% mix of wheat germ, oats, soybeans, and cocoa powder, respectively. Throughout the period of the examination, the study persisted for twenty-eight days. Every week and at the stop of the trial, every rat was once personally weighed earlier than it used to be slaughtered, and blood samples were obtained.

2.2.3. The blood test

At the finish of each trial, blood from each rat's hepatic portal vein has been taken following a 12-hour fasting. After the blood was got into clean, dry centrifuge tubes and allowed to coagulate for 30 minutes in a 37°C water bath, the serum used to be extracted through centrifuging the tubes for 10 minutes at 4000 rpm. The serum used to be cautiously transferred into smooth cuvette tubes, frozen, and subjected to evaluation in accordance with (17).

2.2.4. Biological evaluation

Initial weight was determined when the test was started, also all animals weighed independently at the end of each week and when the experiment finished. According to (18), The FER and BWG have been calculated to provide a biological assessment of the special diets using the following formulas:

$$\text{BWG\%} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \times 100$$

$$\text{FER} = \frac{\text{Gain in body weight (g)}}{\text{Feed intake (g)}}$$

2.2.5. Biochemical assays

Alanine amino-transferase (ALT) and aspartate amino- transferase (AST) have been measured in accordance with the technique's accordance with (19). Alkaline phosphatase (ALP) was quantified using the IFCC techniques (20) protocol. A technique for testing creatinine utilized the procedure of (21). Urea and uric acid in serum was measured in accordance with the techniques as stated by (22) and (23). Triglycerides, total cholesterol and high-density lipoprotein were determined according to (24), (25) and (26). Very low-density lipoproteins and low-density lipoproteins were estimated according to (27) as the following equations: VLDL-c = triglycerides / 5, LDL-c = total cholesterol – (HDL-c + VLDL-c). While glucose has been measured in blood in accordance with (28).

2.2.6. Statistical evaluation

The mean ± SD was once used to express the results. One-way evaluation of variance (ANOVA) used to be used to check the data for comparisons involving more than one variable. As per the statistical package software (29), Duncan's test was once employed as a post test for evaluating the significance between groups.

3. Results and Discussion

Table 1 introduced information on the influence of wheat germ, oatmeal, soybeans, and cocoa powder on the activity of ALT, AST, and ALP in the livers of female rats. It is evident that the treatment group suggested lower ALT liver enzyme degrees with a significant difference from the negative control group, which recorded increase values. The average amount of group with control negative was 56.08 U/L. Serum ALT was lowest in the treated group fed at mixture 15% and highest in the treated group fed at 10% wheat germ with a significant difference (P≤0.05), which were 46.99 and 55.55 U/L.

Concerning the AST liver activates, the group receiving therapy had an extensively lower value in contrast to the control group, which had greater levels. The average amount of the negative control group was 118.12 U/L. In contrast, the smallest therapy groups' AST liver enzyme ranges had been mentioned for rats obtained 15% mix, while the greatest amount recorded for rats received 10% cocoa with a significant difference (P≤ 0.05), which have been 101.64 and 115.59 U/L.

There used to be a significant difference in ALP liver enzyme activity between the treatment group and the control negative group. The average value of the negative control group was 215.35 U/L. The smallest ALP activity of therapy groups recorded for rats obtained 15%mixture. While the greatest amounts recorded

with therapy rats received soybeans10% and soybeans15% with a significant difference, which have been 197.19, 214.63 and 214.15 U/L. These outcomes are stated with those of (30), who claimed that in addition to stimulating estrogen secretion and inhibiting oxidative harm that might also be linked to the presence of biologically active factors such as antioxidant and cyto-protective activities, wheat germ performs a function in hepatic tissues as a herbal defensive antioxidant agent.

Furthermore, (31) discovered that the addition of oatmeal-containing snacks to rats' foods caused a considerable (P≤0.05) drop-in serum liver activities such as ALT, AST, and ALP levels. As tested by using (32) soybean also has an effective influence on liver function symptoms which includes AST, ALP and ALT.

When contrasted with control rats, rat treated with cocoa exhibited a statistically enhanced in hepatic steatosis as properly as a reduce in hepatic lipid peroxides and mitochondrial DNA (33).

Table (1) Influence of wheat germ, oatmeal, soybeans, and cocoa powder on liver enzymes on female rats

Liver Enzymes Tested groups	ALT enzyme U/L	AST enzyme U/L	ALP enzyme U/L
G1 C (-)	56.08f±10.90	118.12h±6.54	215.35f±4.60
G2 (10% Wheat germ powder)	55.55e± 3.10	108.09c±0.76	200.61b±11.97
G3 (15% Wheat germ powder)	54.26de± 2.41	105.75b±2.92	199.98b±4.94
G4 (10% Oatmeal powder)	50.57c±5.55	114.23f±1.81	210.08d±9.04
G5 (15% Oatmeal powder)	49.10c±3.54	113.30f±1.61	209.83d±3.48
G6 (10% Soybeans powder)	55.08e± 1.81	112.05e±4.03	214.63e±2.67
G7 (15% Soybeans powder)	52.12d± 6.45	110.07d±2.83	214.15e±20.13
G8 (10% Cocoa powder)	49.93c±2.63	115.59g±3.15	208.70d±5.39
G9(15% Cocoa powder)	48.00b± 9.95	112.10e±5.63	205.06c±12.77
G10 Mixture 10%	47.85ab±9.35	102.28ab±6.97	198.20ab±78.25
G11 Mixture 15%	46.99a± 5.52	101.64a±1.22	197.19a±8.50
LSD	7.35	4.6	29.36

ALT= Alanine amino transferase. AST=Aspartate amino- transferase. ALP= Alkaline phosphatase. The means ± standard deviations for every value are proven (n = 3). Significant variations (P ≤0.05) can be in the suggestion under the same column with different superscript letters.

The data provided in Table (2) indicate how wheat germ, oatmeal, soybeans, and cocoa powder influence the degrees of serum urea, uric acid, and creatinine in female rats' kidneys. When in contrast to treated groups with a significant difference, the group with control negative had a higher serum urea value, in accordance with the results. The average value of negative control group was 26.06 mg/dl.

On contrast, the treated group's lowest serum urea level ever recorded with treated rats obtained mixture 15%. Although the greatest value ever noted for treated rats which obtained 10% of

oatmeal with a significant difference (P≤0.05), the average amounts have been 17.75 and 25.54 mg/dl.

It is evident that there had been great changes in the blood uric acid values between the treated group and the negative control group, with the former recording a lower value. The negative control group's average result used to be 4.35 mg/dl. On contrast, serum uric acid ranges in treated groups varied considerably (P≤0.05), with the biggest value observed in rats given 10% soybeans and the smallest ranges discovered in rats feeding mixture 15%. These values have been 3.32 and 2.07 mg/dl, respectively.

The acquired results demonstrated that the treated group observed smaller amounts with great variations in serum creatinine ranges comparing to the greater ranges recorded via the group negative control. The average amount of negative control group being 0. 90 mg/dl. While rats given mixture 15% had the lowest serum creatinine degree of any treated group observed. Rats fed 10% Wheat germ and 10% soybeans which were similer had the highest recorded value, with a significant difference (P≤0.05) between the suggest values were 0.49 and 0. 89 mg/dl, respectively. These findings help the concept proposed by means of (34), in accordance with which wheat germ gives efficient renal protection. Wheat germ can also have nephroprotective and free radical-scavenging properties due to the fact it incorporates bioactive aspects that may additionally help counteract the harmful outcomes of unsafe substances. Giving rats oatmeal over a prolonged period helped reduce infection and in consequence enhance kidney function (35).

Bioactive aspects in soybean products effectively avoided the improvement and development of chronic kidney disease linked to extended stem cell-based kidney regeneration and much less tissue inflammation in the kidneys (36).

Foods excessive in polyphenols, like 70% cocoa darkish chocolate, might also be a beneficial tactic to minimize infection and delay the consequences of chronic kidney disease (37).

Table (3) proven the impact of wheat germ, oatmeal, soybeans, and cocoa powder on serum total cholesterol and triglycerides levels on female rats.

The obtained results indicated that the higher serum total cholesterol level recorded for negative control group, while treated groups recorded the lower value with a significant difference. The mean value of the group of control negative was 132.05 mg/dl.

The smallest total cholesterol of treated groups recorded for female rats which given 15%mixture. While the greatest value recorded for female rats which given 10% cocoa with significant difference (P≤0.05), the average amounts were 117.45 and 130.16 mg/dl, respectively.

Table (2) Impact of wheat germ, oatmeal, soybeans, and cocoa powder on kidney functions on female rats.

Kidney Markers / Tested groups	Urea mg/dl	Uric acid mg/dl	Creatinine mg/dl
G1 C (-)	26.06g± 7.23	4.35e± 0.17	0. 90g± 0.02
G2 (10% Wheat germ powder)	22.58d± 2.68	3.16c±0 .15	0. 89f± 0.02
G3 (15% Wheat germ powder)	21.08c± 2.57	2.95c± 0.12	0.88e±0.01
G4 (10% Oatmeal powder)	25.54f±2.51	3.30d± 0.09	0.61c±0.12
G5 (15% Oatmeal powder)	24. 83e± 6.62	2.97c± 0.10	0.59c±0.04
G6 (10% Soybeans powder)	25.13f± 13.95	3.32d± 0.16	0.89f±0 .01
G7 (15% Soybeans powder)	23.34d± 14.77	2.88c± 0.16	0.88e± 0.04
G8 (10% Cocoa powder)	24.40e± 6.45	3.00c± 0.31	0.81d± 0.01
G9(15% Cocoa powder)	23.99e± 6.22	2.93c± 0.34	0.80d± 0.05
G10 Mixture 10%	19.63b± 8.87	2.41b± 0.20	0.51b± 0.01
G11 Mixture 15%	17.75a± 1.43	2.07a±0 .12	0.49a ± 0.02
LSD	9.16	0.22	0.05

The means ± standard deviations for every value are proven (n = 3). Significant variations (P ≤0.05) can be located in the suggestion under the same column with different superscript letters.

In the case of triglycerides levels, data indicated that there are significant differences between negative control group and treated groups. The average amount of the group of the control negative was 124.72 mg/dl which was the highest value compared with treated groups which recorded the lowest values. The lest triglycerides of treated groups recorded for rats' group which given 15%mixture. While the largest value recorded for rats' group which given 10% oatmeal with a significant difference (P≤0.05), the average values were 111.52 and 121.84 mg/dl, respectively. These results support (38) who claimed that oat reduction the total cholesterol extra significantly than triglycerides. Considerable enhancement in triglycerides can be achieved by modifying the amount or duration of oat intake, or by combining oats with a healthy diet plan.

According to (39), the findings revealed alternate uses of cocoa wastes in the management of hypertriglyceridemia.

Animal metabolism was improved by cocoa derivatives. Also, (40), mentioned that Soybeans are an incredible way to obtain excellent plant protein that can lower blood stress and plasma cholesterol.

Table 4 demonstrates how the ranges of high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c), and very low-density lipoprotein cholesterol (VLDL-c) in female rats had been affected by using wheat germ, oats, soybeans, and cocoa powder. There has been a significant difference in high density lipoprotein cholesterol (HDL-c) between the treatments and negative control groups. The therapy groups had

increased HDL-c levels, and there used to be a significant difference in the smaller value recorded by means of the negative control group. The average amount of the gative control group was 41.10 mg/dl.

Table (3): Influence of wheat germ, oatmeal, soybeans, and cocoa on cholesterol and triglyceride levels on female rats

Parameters Tested groups	Total cholesterol mg/dl	Triglycerides mg/dl
G1 C (-)	132.05g ± 2.51	124.72h± 4.20
G2 (10% Wheat germ powder)	119.59bc± 2.31	118.95e± 2.69
G3 (15% Wheat germ powder)	119.17bc± 8.34	117.14d± 6.05
G4 (10% Oatmeal powder)	121.82d± 9.22	121.84g± 8.73
G5 (15% Oatmeal powder)	121.00c± 9.97	119.81f± 10.66
G6 (10% Soybeans powder)	124.95ef± 3.70	121.36g± 9.18
G7 (15% Soybeans powder)	123.20e±1.58	120.95g± 4.48
G8 (10% Cocoa powder)	130.16f± 4.32	115.81c± 4.31
G9(15% Cocoa powder)	129.15f±7.61	113.03b± 8.83
G10 Mixture 10%	118.40b± 6.61	112.39b± 3.48
G11 Mixture 15%	117.45a± 6.23	111.52a± 4.17
LSD	7.33	7.66

The means ± standard deviations for every value are proven (n = 3). Significant variations (P ≤0.05) can be in the suggestion under the same column with different superscript letters.

The rat group's HDL-c used to be the biggest among the remedy groups which given 15%mixture. While lest value recorded for rats' group which given 10% soybeans and 15% soybeans which were similar with a significant difference (P≤ 0.05), the average amounts were 51.75, 43.81 and 43.37 mg/dl, respectively.

Data on LDL-c ranges confirmed that the treated and negative control groups differed considerably from one another, average amount of group control negative was 66.01mg/dl.

The rats in the treatment groups that mixture 15% and mixture 10% combination had the lowest LDL-c levels. The group of rats given 10% cocoa had the highest recorded value (P≤0.05), with a significant difference (P≤0.05) in suggest values of 46. 93, 46.43 and 62.63 mg/dl, respectively.

Regarding very low-density lipoprotein cholesterol ranges (VLDL-c), it might also be found that the groups receiving therapy recorded decreased amounts with a significant difference, whereas the negative control group recorded higher values. The control negative group's average quantity was 24.94 mg/dl. The therapy groups' lowest VLDL-c used to be viewed in rats fed a 15% mixture. Rats given 10% oatmeal had the highest recorded value, with a significant difference (P≤0.05), alternatively the average quantities have been 22.30 and 24.37 mg/dl, respectively. These data suggest the theory put up by (41), found that wheat germ protein remedy

improved antioxidant activity, decreased serum lipid level, and extended the activity of enzymes involved in cholesterol breakdown, it may also be an advantageous capacity of stopping hyperlipidaemia and its consequences.

In general, oats and their products are viewed as healthful, and consuming oat bran is notion to decrease low density lipoprotein cholesterol (42).

Moreover, (43), discovered that isolated soy protein significantly reduced serum lipid fraction concentrations in postmenopausal women. According to (44), dark chocolate and cocoa intake have been related with lower serum degrees of LDL cholesterol and fasting blood glucose.

Table (4) Effect of wheat germ, oatmeal, soybeans, and cocoa powder on serum lipid profile on female rats

Parameters / Tested groups	HDL-C mg/dl	LDL-C mg/dl	VLDL-C mg/dl
G1 C (-)	41.10a± 1.96	66.01h± 5.00	24.94e±0.83
G2 (10% Wheat germ powder)	44.54c± 2.22	51.27c± 2.21	23.78c±0.54
G3 (15% Wheat germ powder)	45.70d±1.37	50.04b± 7.17	23.43b±1.21
G4 (10% Oatmeal powder)	46.25e± 1.84	51.20c± 2.77	24.37d±1.74
G5 (15% Oatmeal powder)	46.65e± 1.22	50.39b± 8.15	23.96c±2.13
G6 (10% Soybeans powder)	43.37b± 1.47	57.31e±9.10	24.27d±1.84
G7 (15% Soybeans powder)	43.81b± 1.35	55.20d± 1.32	24.19cd±1.89
G8 (10% Cocoa powder)	44.37c± 2.35	62.63g±2.79	23.16b±1.84
G9(15% Cocoa powder)	46.36e± 1.22	60.18f±3.73	22.61ab±1.86
G10 Mixture 10%	49.49f± 1.41	46.43a±7.91	22.48a±1.77
G11 Mixture 15%	51.75g± .87	46.39a± 5.87	22.30a±1.70
LSD	1.83	6.61	1.53

HDL-c= High-density lipoprotein. HDL-c=Low-density lipoproteins. VLDL-c= Very low-density lipoproteins. The means ± standard deviations for every value are proven (n = 3). Significant variations (P ≤0.05) can be in the suggestion under the same column with different superscript letters.

Table (5) proven the impact of wheat germ, oatmeal, soybeans, and cocoa powder on glucose levels on female rats. The treated groups and negative control groups range considerably from one another. The glucose levels recorded for the group of control negative the average amount was (134.76), while treated groups recorded the smaller value with a significant difference.

The female rats in the 15% mixture group had the less measured glucose degrees amongst the treated groups. The group of female rats given 10% cocoa and 10% soybeans had the high recorded value, with a significant difference (P≤0.05). The mean values have been 121.27, 133.75 and 133.62 mg/dl, respectively. These findings are steady with these of (45), who hypothesized that whilst wheat germ dietary supplements may additionally supply humans with a less expensive way to enhance their glycemic management, they only have a minor impact on intestinal health.

Moreover, (46) discovered that eating meals fortified with oatmeal high in carbs lowers glycaemic and insulinemic responses.

Results confirmed that soybean oligosaccharides considerably reduced ordinary blood glucose in rats or animal models at every dosage investigated (47). Additionally, cocoa and its flavonoids may additionally have a useful impact on the physiological pathways underlying vessel dysfunction and resistance to insulin (48).

Table (5): Effect of wheat germ, oatmeal, soybeans, and cocoa on glucose levels on female rats

Parameters Tested groups	Glucose mg/dl
G1 C (-)	134.76h±3.95
G2 (10% Wheat germ powder)	129.12d±14.11
G3 (15% Wheat germ powder)	128.28c±14.65
G4 (10% Oatmeal powder)	123.72b±6.20
G5 (15% Oatmeal powder)	123.21b±4.32
G6 (10% Soybeans powder)	133.62g±4.52
G7 (15% Soybeans powder)	132.91f±2.21
G8 (10% Cocoa powder)	133.75g±5.34
G9(15% Cocoa powder)	131.56e±5.50
G10 Mixture 10%	121.99ab±5.59
G11 Mixture 15%	121.27a±5.43
LSD	8.76

The means ± standard deviations for every value are proven (n = 3). Significant variations (P ≤0.05) can be in the suggestion under the same column with different superscript letters.

The influence of wheat germ, oatmeal, soybeans, cocoa and their mixture as powder on body weight gain, feed intake and feed efficiency ratio on female rats are shown in Table (1). Data obtained from body weight gain proves the therapy and negative control groups differed considerably from one another. The value of the negative control group was 44.14g.

On contrast, the greater BWG of treated groups recorded for 15% mixture, while the smaller amount recorded for10% cocoa with a significant difference (P≤ 0.05), the corresponding amounts were 55.82 and 45.03g, respectively.

In the case of FI, results concluded that the treated group and the untreated negative group vary significantly; the average range of control negative group being 20.50g/day.

The data collected additionally showed that the greatest FI of treated groups recorded for mixture 15% and 10% mixture. While lest amount recorded for rats given 10% cocoa with a significant difference (P≤ 0.05), the corresponding amounts were 29.67, 29.33 and 22.50g, respectively.

On contrast, data obtained from FER indicated the treatment and negative control groups range notably from one another; the suggest value of negative control group was 0.057%.

The greatest FER of treated groups recorded for15% mixture. While lest amount recorded for rats given 15% soybeans and 10% cocoa which were similar with a significant difference (P≤ 0.05), the average amounts were 0.080 and 0.064%. These findings are constant with (49), which noted that the statistics revealed a constant reduce in FER and an increase in final BWG for rats given Balady

bread fortified with wheat germ as in contrast to the control group.

Value-added items can be made from wheat waste products like wheat germ. It used to be located to have considerable health advantages and useful properties, as nicely as being an excellent supply of a range of nutritionally effective components (50), they substantiated that the White rats fed wheat germ diet gain weight each on a common day and in terms of body weight.

Additionally, (51) observed that oatmeal protein gives people and different monogastric mammals a higher stability of most essential amino acids. Oats have significantly greater portions of crude fats than different cereal grains, which makes them extra famous for feeding cattle due to the fact they supply greater calories (metabolizable energy) (52), showed that Protein, fats, fiber, and active substances like isoflavones, which are additionally phytoestrogens, are all discovered in soybeans. The outcomes confirmed that the body weight increase, and fats proportion had been managed with the aid of soy isoflavones.

The data gathered helps the findings of (53), who referred to that most conveniently handy soluble cocoa products and sweets are excessive in sugar and energy and have little flavonoid content. As a result, eating a lot of chocolate will make you gain weight.

Table (6): Effect of wheat germ, oatmeal, soybeans, and cocoa powder on body weight gain, feed intake and food efficiency ratio on female rats

Parameters Tested groups	Body weight gain (g)	Feed intake (g/day)	Feed efficiency ratio (%)
G1 C (-)	44.14a± 17.35	20.50a± 1.05	0.057a± 0.26
G2 (10% Wheat germ powder)	51.00f± 15.59	27.83e± 0.75	0.067c± 0.09
G3 (15% Wheat germ powder)	52.62g± 8.42	28.50f± 0.84	0.063ab± 0.19
G4 (10% Oatmeal powder)	48.77d±1.72	27.00e± 1.41	0.065bc±0.03
G5 (15% Oatmeal powder)	50.70e± 8.96	27.17e± 1.47	0.072d±0.10
G6 (10% Soybeans powder)	47.92c± 7.18	25.83d± 0.75	0.065bc± 0.08
G7 (15% Soybeans powder)	49.52e±4.51	26.00c± .89	0.064b±0.08
G8 (10% Cocoa powder)	45.03b± 7.71	22.50b± 1.38	0.064b± 0.09
G9(15% Cocoa powder)	45.50b± 8.01	24.67c± 1.03	0.066c± 0.10
G10 Mixture 10%	54.68gh±5.23	29.33g± 1.21	0.071d± 0.08
G11 Mixture 15%	55.82h± 11.49	29.67g±0 .82	0.080e±0.02
LSD (P≤ 0.05)	11.32	1.26	0.15

The means ± standard deviations for every value are proven (n = 3). Significant variations (P ≤0.05) can be in the suggestion under the same column with different superscript letters.

5. Conclusion

Certain cereals and grains, such as wheat germ, oatmeal, soybeans, and cocoa powder, have been found to promote weight gain in rats. These findings support our theory that these foods contain beneficial chemical substances that positively impact body weight and

biochemical analysis. Consequently, we recommend incorporating these selected foods into our daily diets.

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التغذية وعلوم الاطعمة

التأثيرات البيولوجية لبعض التركيبات الغذائية من الحبوب على زيادة الوزن فى إناث الفئران

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الملخص العربى:

تعتبر الأغذية الوظيفية ومصادر البروتين البديلة فرصة محتملة لتلبية جميع الاحتياجات الغذائية. الهدف من هذه الدراسة هو معرفة كيف يمكن لمسحوق جنين القمح والشوفان وفول الصويا والكاكاو بتركيزات مختلفة أن حسن وزن الجسم لدى إناث الفئران. تم استخدام ١١ مجموعة من الفئران، بكل منها ٦ فئران، من ٦٦ إناث فئران الالبينو، وزن كل منها ١٢٠ ± ١٠ جرام. المجموعة الأولى وهي مجموعة التحكم السلبية تغذت على النظام الغذائي الأساسي فقط. المجموعتين الثانية والثالثة تغذتا على النظام الغذائي الأساسي والمضاف إليه ١٠ ،١٥٪ مسحوق جنين القمح. المجموعتين الرابعة والخامسة تغذتا على النظام الغذائي الأساسي والمضاف إليه ١٠ ،١٥٪مسحوق دقيق الشوفان. المجموعتين السادسة والسابعة تغذتا على النظام الغذائي الأساسي والمضاف إليه ١٠ ،١٥٪ مسحوق فول الصويا. المجموعتين الثامنة والتاسعة تغذتا على النظام الغذائي الأساسى والمضاف إليه ١٠ ،١٥٪مسحوق الكاكاو. المجموعة العاشرة والحادية عشرة تغذتا على النظام الغذائي الأساسي والمضاف إليه ١٠ ،١٥٪ خليط من جنين القمح، والشوفان، وفول الصويا والكاكاو. وفي نهاية فترة التجربة (٢٨ يومًا) تم وزن الفئران كل فأر على حدة وصيام الفئران لمدة (١٢) ساعة قبل ذبحها. تم قياس الزيادة فى وزن الجسم والغذاء المتناول ونسبة كفاءة التغذية. تم جمع عينات الدم لإجراء التحاليل البيوكيميائية مثل مستوى سكر الدم ووظائف الكبد والكلى وصورة دهون الدم. وقد أشارت النتائج إلى أن التغذية على مسحوق جنين القمح والشوفان وفول الصويا والكاكاو تسببت في تحسينات معنوية في زيادة وزن الجسم وكل التحاليل الكيميائية الحيوية. وفي الختام، يمكن أن يؤدي استخدام مسحوق تركيبة الحبوب إلى تحسين وزن الجسم لدى الأشخاص الذين يعانون من نقص الوزن.

الكلمات المفتاحية: الأغذية الوظيفية، مخلوط الحبوب، إنزيمات الكبد، وظائف الكلى، زيادة الوزن.