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The Effect of Different Cereal Brans as Food Additives and Biological Studies on Hyperglycemic Rats

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Abstract: The present work aimed to evaluate the effect of (oats bran , corn bran and wheat bran)adried powders , the combination of all(10%) on diabetic rats. For this purpose , the study included 30 rats about 100/140(g) weight. Biological & chemical analysis of serum and histopathological investigation of internal organs were carried out. The results could be summarized as follows:

- Due to diabetes, BWG lowered and FI reaisedwhen diabetic rats feeding on basal diet contained (oats, corn or wheat brans)adried powders**.**
- Due to diabetes, serum glucose level was raised, but when feeding on basal diet contained (oats, corn and wheat brans)or mixureaconcentration(10%) it decreased . Feed with oats bran recorded the highest decrement HB level **.**
- Followed the same trend also increased TC , TG, LDL & VLDL ,While, decreased the serum HDL **.**

Key word : oats bran , corn bran, wheat bran, blood glucose, lipids profiles.

Introduction

Diabetes is a disease in which blood glucose, or blood sugar, levels are too high. Glucose comes from the foods eaten. Insulin is a hormone that helps the glucose get into our cells to give them energy. With type one diabetes, body does not make insulin**(Mathersetal.,2006).** With type twe diabetes, is more common type, body does not make or use insulin well. Without enough insulin, glucose stays in our blood. We can also have prediabetes. This means that blood sugar is higher than normal but not high enough to be called diabetes. Having prediabetes puts us at a higher risk of getting type 2 diabetes **(International Diabetes Federation , 2006).**

Over time, having too much glucose in blood can cause serious problems. It can damage eyes, kidneys, and nerves. Diabetes can also cause heart disease, stroke and even the need to remove a limb. Pregnant women can also get diabetes, called gestational diabetes **(Barrettetal.,2012).**

Blood tests can show if t the person have diabetes. One type of test, the HbA1c, can also check on how you are managing your diabetes. Exercise, weight control and sticking to meal plan can help control diabetes. We should also monitor our blood glucose level and take medicine if prescribed **(Kitabchi et al.,2009).**

Bran of whole wheat grain is your address to fight aging, cancer and chronic diseases(**Arguedasetal ,2013**). wheat bran or roast is a solid outer layer of grain, often produced as a byproduct of the mills by producing refined flours which remove their outer husks. When the bran is removed from the grain, the grains lose a large part of their nutritional value. **(Krishnasamy and Abell., 2018).**

Oat bran is rich in fiber, soluble in water, and after combining with water and absorbing it, it gives a thick mixture that is rapidly reduced in the intestinal flap, so it is very important to get rid of chronic constipation**.(Cukierman.,2005).**

Eating oat bran also helps to improve the metabolism of glucose in the blood, especially in people who complain of diabetes, which limits the use of insulin or antihypertensive drugs**(WHO., 2013).**

Corn bran or miller's bran is a solid outer layer of grain, consisting of a common alkaloids .and together with germs, are an integral part of whole grains, and are often produced as a by-product of the mills through the production of refined flour **(Rosberger.,2018)**. When the

bran is removed from the grain, the grains lose part of their nutritional value**(Aril,2013).**

Materials and Methods

Materials:

- Casein, all vitamins, all minerals, cellulose, cholinchloride, Methionine, alloxanwere obtained from El-Gomhoria Company for Drugs and Medical Equipments, Cairo, Egypt.
- Oats,corn and wheat brans were obtained from locl market of Menoufia , Egpyt.
- Adult male albino rats, were obtained from the lab of Facultyof Home Economics ,MenoufiaUniversity **.**

Diets:

Basal Diet:

The basal diet was consisted of 20% protein (casein), 10% sucrose, 4.7% corn oil, 2% choline chloride, 1% vitamin mixture, 3.5% salt mixture and 5% fiber (cellulose). Corn starch up 100% **(Astoor*et al*.,2016).**

Methods:

Preparation of grains:

The above mentioned grains were done grinding by using an electric mill to obtain a fine powder. This powder was kept in glass jars which were sealed good ,then kept in dry cool place until used. **(Saydah*et al*.,2001).**

Preparation of diabetic rats (alloxan):

Diabetes was induced in normal healthy male albino rats via intraperitoneal injection of alloxan(150 mg/kg body weight). Six hours after injection of alloxan, fasting blood samples were obtained by retro – orbital method to estimate fasting serum glucose. Rats having fasting serum glucose more than 160 (mg/dl) were considered diabetics**. (Santaguida*et al*.,2008).**

Experimental Desgine:

The rats were divided into 6 groups (5 rats each);the first group used as a control group(-) and was fed on control basal diet, while the other groups were fed on hyperglycemia diets supplemented with different plant levels at 10 %, all groups were fed for 28 days as follows:

Group (1): Normal rats fed on basal diet only for the duration of the experiment, as a control negative (-) group (healthy rats).

Group (2): Diabetic rats fed on basal diet only as a control positive (+) for diabetic rats.

Group (3): Diabetic rats fed on basal diet with substitution of 10% dried powder from oats bran.

Group (4): Diabetic rats fed on basal diet with substitution of 10% dried powder from corn bran**Group (5):**Diabetic rats fed on basal diet with substitution of 10% dried powder from wheat bran.

Group (6): Diabetic rats fed on basal diet with substitution of 10% dried powder of mixture of all brans.

Results and Discussion

Table (1): Effect of Oats, Corn, Wheat and their mixtures Bran on BWG, FI & FER of rats

Treatment/Parameter	BWG (g)\d	FI (g)\d	FER (g)\d
Control group (-)	**3.13^{a}±0.97**	**14.10^{b}±0.21**	**0.22^{a}±0.50**
Control group (+)	**2.70^{b}±1.12**	**16.97^{a}±0.21**	**0.16^{c}±0.70**
Oats bran	**2.72^{b}±1.01**	**12.60^{d}±1.00**	**0.22^{a}±0.41**
Corn bran	**3.04^{ab}±0.66**	**14.30^{b}±0.20**	**0.21^{a}±0.60**
Wheat bran	**3.05^{ab}±0.95**	**14.55^{ab}±0.25**	**0.20^{a}±0.61**
Mixture bran	**2.62^{c}±0.15**	**13.61^{c}±0.57**	**0.19^{b}±0.21**
L.S.D	**0.81**	**0.89**	**0.74**

Data are expressed as mean ±SD. Values within row having superscripts are significantly .Different($P \leq 0.05$).by one way ANOVA followed by Duncan's multiple range test (a,b,c,d,e).

The mean value of body weight gain of rats fed on various diets was shown in table (1). It could be noticed that the mean value of (BWG) of control (+) group was lower than control (-) group being 2.70 (g) and 3.13 (g), respectively. Which showing significant difference as compared to control (-) group. While, wheat bran recorded the highest BWG, while the lowest value recorded for corn group .while, mixture bran with a significant difference as compared to wheat bran group. The mean values were 1.04(g) and 0.65(g), respectively. This was also reported by ***(Haw, J et al.,2017)*** showed that corn ,oats and mixture group contained low of total BWG when compared to control (-) while(Bartte ,k.and Al ,M .,2001) Showed that high BWG in group wheat bran.

Also , the mean value of feed intake gain of rats fed on various diets was shown in table (1).It could be noticed that the mean value of (FI) of control (+) group was higher than control (-) group being 16.97 (g) and 14.10 (g), respectively. Which showing significant difference as compared to control (-) group. While, wheat bran recorded the highest FI, while the lowest value recorded for oats bran with a significant difference as compared to wheat group. The mean values were 12.60 (g) and 14.55 (g), respectively. This was also reported by ***(Mottalib, A et al.,2017)*** showed that oats group high FI and low in corn bran group when compare to control groups.

In case of feed efficiency ratio gain of rats fed on various diets was shown in table (1). It could be noticed that the mean value of (FER) of control (+) group was lower than control (-) group being 0.16(g) and 0.22(g), respectively. Which showing no significant difference as compared to control (-) group. While, oats bran recorded the highest FER , the lowest value recorded for mixture brans, corn and wheat bran with no significant difference as compared to wheat bran group. The mean values were 0.21(g) and 0.20 (g), respectively. ***(Emadian, A et al.,2015)*** reported that FER was high in oats ,corn and wheat brans.

Lipid profile :

Table (2): Effect of Oats, Corn, Wheat and their mixtures brans on Lipid Profile of rats

Treatment/Parameter	TC(mg\dl)	TG(mg\dl)	HDL(mg\dl)	LDL(mg\dl)	VLDL (mg\dl)
Control group (-)	**86^{a}±8**	**63.5^{a}±8.5**	**32.5^{a}±9**	**40.8^{b}±10.9**	**12.7^{a}±.8**
Control group (+)	**91^{a}±9.5**	**73^{a}±7.5**	**30^{a}±7.5**	**46.4^{a}±6.9**	**14.6^{b}±3.1**
Oats bran	**79^{a}±9.5**	**59.5^{a}±11**	**44^{a}±8.5**	**23.1^{c}±7.5**	**11.9^{a}±1.3**
Corn bran	**76.5^{a}±9**	**60.7^{a}±11.8**	**39^{a}±9.5**	**25.4^{c}±6.5**	**12.1^{a}±1.3**
Wheat bran	**76.5^{a}±7**	**60.1^{a}±11.5**	**40^{a}±9.5**	**24.5^{c}±7.1**	**12^{a}±1**
Mixture bran	**72.5^{a}±10.8**	**52.8^{a}±9.1**	**38^{a}±9.5**	**23.9^{c}±6.5**	**10.6^{a}±1.1**
F Value	**1.7**	**0.4**	**0.5**	**5.3**	**0.7**
L.S.D(P≤0,05)	**16.1**	**17.8**	**9.2**	**13.7**	**2.8**

Data are expressed as mean ±SD. Values within row having superscripts are significantly .Different(P≤0.05).by one way ANOVA followed by Duncan's multiple range test (a,b,c,d,e).

The mean values of cholesterol gain of rats fed on various diets was shown in **table (2).** It could be noticed that the mean value of (TC) of

control (+) group was higher than control (-) group being 91 vs 86 mg\dl , respectively. Which showing no significant difference as compared to control (-) group. While, oats and wheat diets recorded the highest (TC), the lowest value recorded for the mixtures.the mean values were 79 and 72.5 mg\dl, respectively. This trend was also reported by **(Grams *et al*.,2015).**

Results concerning triglycerides in table (2) showed that there were no significant difference (p>005) between all groups under study .

Moreover , high density lipoprotein of rats fed on various diets was shown in **table (2) .** It could be noticed that the mean value of (HDL) of control (+) group was less than control (-) group being 30 and 32.5 mg\dl, respectively. Which showing no significant difference between them. While, oats recorded the highest (HDL), the lowest value was recorded with mixtures bran , corn and Wheat bran with no significant difference as compared to Oats group. The mean values were 44 vs 38 mg\dl, respectively. This trend of changes was also reported by **(MacIsaac*et al.*,2018).**

The mean value of low density lipoprotein of rats fed on various diets was shown in **table (2) .** It could be noticed that the mean value of (LDL) of control (+) group was higher than control (-) group being 46.4 vs 40.8 mg\dl, respectively. Which showing significant difference (P≤0.05) between them . While, oats bran recorded the highest (LDL), while the lowest value recorded for the mixure diet with significant difference (P≤0.05) . The mean values were 25.4 vs 23.9, respectively. This trend of changes was also reported by **(Pozzilli*et al.*,2014).**

On the other hand, the mean values of very low density lipoprotein of rats fed on various diets was shown in **table (2).** It could be noticed that the mean value of (VLDL) of control (+) group was higher than control (-) group being 14.6 and 12.7 mg\dl, respectively. Which showing no significant difference between them . While, corn recorded the highest (VLDL), the lowest value recorded for mixture of oats, corn and bran with no significant difference as compared to Corn group. The mean values were 12.1 and 10.6 mg\dl, respectively. This trend of change also reported by **(Krentz and Bailey .,2005).**

Table (3): Effect of Oats, Corn,Wheat and their mixture brans on Random Blood Glucose (RBs)& Hemoglobin (HB)of rats

Treatment/Parameter	Glucose (mg\dl)	HbA1c (mmol\mol)	HB (g\dl)
Control group (-)	**114.00^{c}±9.00**	**5.70^{b}±0.90**	**15.50^{ab}±0.90**
Control group (+)	**160.00^{a}±10.00**	**7.13^{a}±0.950**	**14.70^{b}±0.90**
Oats bran	**90.01^{d}±9.00**	**4.39^{c}±0.80**	**17.50^{a}±1.20**
Corn bran	**112.67^{c}±6.75**	**5.27^{c}±0.35**	**16.50^{ab}±1.10**
Wheat bran	**119.57^{b}±9.75**	**5.41^{b}±1.00**	**15.73^{ab}±0.85**
Mixture bran	**110.00^{c}±7.00**	**5.60^{b}±0.85**	**16.70^{ab}±1.10**
L.S.D.	**15.43**	**1.48**	**1.808**

Data are expressed as mean ±SD. Values within row having superscripts are significantly .Different(P≤0.05).by one way ANOVA followed by Duncan's multiple range test (a,b,c,d,e).

The mean values of random blood Sugar (Glucose) of rats fed on various diets was shown in table (6) . It could be noticed that the mean value of (Glucose) of control (+) group was higher than control (-) group being 160.00(mg\dl) and 114.00(mg\dl), respectively. Which showing significant difference (P≤0.05) as compared to control (-)group. While, wheat bran recorded the highest (Glucose), while the lowest value recorded for oats with significant difference (P≤0.05) as compared to corn,wheat,and mixture brans groups . The mean values were 90.01(mg\dl) and (119.57,112.67,110.00) (mg\dl), respectively. This trend of changes was also reported by ***(American Diabetes Association.,2014)***

On the other hand, the mean value of glycated hemoglobin was shown in table (6) . It could be noticed that the mean value of (HbA1c) of control (+) group was higher than control (-) group being 7.13 (mmol\mol) and 5.70 (mmol\mol), respectively. Which showing significant difference (P≤0.05) as compared to control (-) group. While, mixture bran group recorded the highest (HbA1c), while the lowest value recorded for oats with significant difference (P≤0.05) as compared to mixture bran group. The mean values were 4.39 (mmol\mol) and 5.60

(mmol\mol), respectively. This trend of changes was also reported by ***(Polisena, J et al.,2009).***

In the case of the mean value of hemoglobin gain of rats fed on various diets values are shown in table (6) . It could be noticed that the mean value of (HB) of control (+) group was Lower than control (-) group being 14.70(g\dl) and 15.50(g\dl), respectively. Which showing no significant difference as compared to control (-) group. while oats recorded the highest (HB), the lowest value recorded for wheat bran with no significant difference as compared to oats group. The mean values were 17.50(g\dl) and 15.73(g\dl), respectively. This trend of changes was also reported by ***(Gale, E,A et al.,2001)*** Results of table(6) obtained by ***((American Diabetes Association.,2014); (Polisena, J et al.,2009); (Gale, E,A et al.,2001))*** they found that oats and corn brans decreased (RBs and HBA1c) .but it increased (HB) in the blood .

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تأثير نخالة الحبوب المختلفة كمواد مضافة للأغذية ودراستها بيولوجيا علي الفئران المصابة بمرض السكر

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الملخص العربي

يهدف هذا العمل إلي دراسة تأثير نخالات الذرة والشوفان والقمح (الردة) وخليط من جميع هذه النخالات علي الفئران التي تمت إصابتها بمرض السكر عن طريق الحقن بمادة الألوكسان وذلك بخفض مستوي السكر في الدم بواسطة هذةالنخالات وقد تم طحن هذةالنخالات جيدا بعد تجفيفها لتصبح ناعمة حتي لا تحدث إعاقة أثناء إعطائها للفئران وذلك بتركيز 10% من هذه النخالات وأيضا 10 % من مخلوطهم .

وتم إجراء التحاليل البيولوجية و الكيميائية لمصل الدم .

وظهرت النتائج والتي يمكن تلخيصها علي النحو التالي :-

- بالإصابة بالسكري قل مؤشر اكتساب الوزن (BWG) و الغذاء المتناول (FI) للفئران
- زاد مؤشر (FER) وذلك بعد حقن الفئران وتغذيتها علي النخالات (الشوفان ، الذرة ، الردة و المخلوط) وذلك لتحسن التمثيل الغذائي في الجسم
- بعد الاصابة للفئران زاد مستوي الجلوكوز وفي مصل الدم للفئران ولكن عند إطعامها النظام الغذائي الاساسي بالإضافة الي 10 % من النخالاتإنخفض مستوي الجلوكوز وخاصة في المجموعة الثالثة التي تتغذي علي الشوفان حيث حققت افضل النتائج وذلك بالمقارنة بالمجموعات الأخرى وخاصة المجموعة (كنترول موجب) .
- بتغذية الفئران المصابة بالسكري علي الغذاء الأساسي بالإضافة الي النخالات ادي ذلك الي انخفاض مستوي (TC,LDL,VLDL,TG) .
- الفئران التي تغذت علي العليقة الأساسية بالإضافة الي نخالة الشوفان وخليط النخالات (المجموعة الثالثة والسادسة) حققت أعلي نسبة انخفاض في مستوي (LDL) .

الكلمات المفتاحية : نخالات الشوفان – الذرة – الردة – سكر الدم – وحالة الدهون .