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The effect of some pervasive junk food among school students on biological changes in rats

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Abstract

This work was carried out to study the effect of using various types of junk food commonly used by primary and preparatory school students,and the biological evaluation on male rats Sprague Dawley Strain (70±10 g)the study continued for 45 days. Six groups of rats, each contains 5 rats, were fed on different tested diets Group (1): Control group rats were fed on basal diet. Group (2): rats were fed on basal diet supplemented with 10% of tomato flavor potato Chips. Group (3): rats were fed on basal diet supplemented with 10% of Doritos (sweet chili pepper). Group (4): rats were fed on basal diet supplemented with 10% of Windows (cheese flavor). Group (5): rats were fed on basal diet supplemented with 10% of Sunbites (cheese and herbs). Group (6): rats were fed on basal diet supplemented with 10% of Indomie (chicken curry flavor).Chemical, biological, biochemical and histological tests were carried out.The results indicated that junk food contains high amount of fat and carbohydrates, and relatively low amount of protein and fibers. It also has a bad effect on kidney function, liver enzymes, immunoglobulin serum, brain enzymes, total antioxidant and lipid profile. However, there is an increase in the feed efficiency ratio (FER) and body weight gain (BWG) in all groups compared to the control group although the increase was not significant. It was concluded that junk food has a bad effect on health and may lead to a lot of diseases, especially for school students.We recommend that further studies should be done to find out the type of food additives.
Key words:junk food, total Antioxidant, brain enzymes, immunoglobulin system, Lipid profile.

Introduction

Neill, (2006) found that junk food is high in calories and lacks micronutrients ; vitamin, minerals and fiber.Junk food includes high levels of sugar, white flour, Tran's fats, polyunsaturated fat, salt, and various food additives such as monosodium glutamate and tartrazine.Junk foods are made of processed foods and are rated high on the glycaemic scale, meaning they have rapid rise in blood sugar, but it rapidly decreases thenthe appetite increases ***Bayolet al., (2009).***The authors added that fats and oils along with spices added in these foods function as an irritant to stomach mucosa causing increased stomach acid secretion that may lead to gastritis.

High salt and Tran's fats (thermally oxidized oils) raise the risk of heart disease and generate free radicals that are involved in many diseases such as cancer, diabetes, arthritis, and cataract. Acrylamide (ACR) is an aggravating element of unhealthy chips ***Lunec, (1992).*** The concentration of

acrylamide (ACR) ranged from 376 to 2348 µg / kg in fried potato chips ***Nojskaet al., (2008).*** Dietary ACR is largely derived from heat induced reactions (Maillard reaction) between the free amino acid precursor asparagine and carbonyl groups of glucose and fructose ***Friedman and Levin, (2008).*** Orally ingested ACR is absorbed into the bloodstream and then spread to the different organs, interacting with DNA, neurons, haemoglobin and essential enzymes, creating many neurotoxicants and mutagenic germ cells ***Klaunig, (2008), Rayburn and Friedman, (2010).***

Junk foods are easily addictive and can show the seeds of infirmity and chronic illness, which ultimately leads to many incurable diseases. Studies ***of Anderson and Butcher, (2006)*** revealed early artery clogging as 30 years of age-Prostate and breast cancer risks associated with their eating habits at puberty-early age environment of hypertension and osteoporosis,slow growth risk, decay of the tooth and obesity. Junk food might contain substances which can be allergic and may cause rashes and hypersensitivity. They may be inedible, toxic or carcinogenic. Animal rat studies have shown the ill effects of eating junk foods during pregnancy that affect the health of foetus **Bayol*et al*., (2009).**Junk foods deficient in calcium and magnesium are responsible for osteoporosis. Free sugar-rich diets may also result in increased risk of dental caries ***Kaushiket al., (2011).***

Junk food intake has a significant negative impact on psychological health Participants who ate processed foods were at risk of mental health problems and a strong association between junk food intake and child depression **(*Sherozeet al., 2017).*** Junk foods have been shown to induce dyslexia, attention deficit hyperactivity disorder(ADHD) and worse autism **(Hovenkamp*et al*., 2008).** Studies published in Neurology showed that eating too much junk food or Tran's fats rich food could shrink the brain close to Alzheimer's disease ***(Sapna Johnson et al., 2012).***Even if they are physically fit and in good health, junk food can make young men infertile. Those who consumed high quantities of junk food such as fried foods and potato chips were found to have lower quality sperm than their counterparts who ate a nutritious diet ***(Sapna Johnson et al., 2012).***
The study was carried out to study the effect of the mostly used junk food by students on experimental animals

Materials and Methods

Materials and animals:

Junk foods: Chipsy (tomato flavor), Sun bites (cheese and herbs), Doritos (sweet chili pepper), Windows (cheese flavor) and Indomie (chicken curry flavor) were purchased from local market, Cairo, Egypt and milled to coarse powder to be ready for supplementation.
Casein, vitamins, minerals, cellulose and choline chloride were purchased from El-Gomhoreya Company, Cairo, Egypt.
Oil and starch were purchased from local market, Cairo, Egypt.
Thirty male albino rats (Sprague Dawley Strain) were obtained from Food Technology Res. Institute, Giza.

Methods:

Sample and data collection

We started the study by visiting two primary and two preparatory schools in Sharkia governorate and followed the method of rapid assessment procedure***(Scrimshaw and Gleason,1992)*** in the first semester 2018-2019.Self-reported questionnaires were distributed to students to report on the most frequently used junk food and how often (table 9).
Junk foods were milled to coarse powder to be ready for supplementing the diet.

Chemical analysis:

Chemical analysis of the most common junk food consumed by the students including protein, carbohydrate, oils, moisture and ash were conducted in Food Technology Res. Institute according to the method described by the ***A.O.A.C., (2003).***

Experimental design:

Male albino rats Spargue Dawley Strain (30 rats) weighing (70±10 g) were kept in individual stainless steel cages under hygienic conditions and fed one week on basal diet according to ***Reeves et al ., (1993)*** for adaptation in the animal house of Agricultural Res. Center in Ministry of Agriculture), Giza. The basal diet consisted of casein 10%, cellulose 5%, corn oil 10%, salt mixture 4%, vitamin mixture 1% and the remaining amount was starch according to ***Lane-Peter and Pearson, (1971).***

The supplemented diets were prepared by adding 10% of each on the commonly used junk foods to the basal diet. After the adaptation period,the experimental animals were divided into 6 groups each group contained 5 rats:

Group (1): control,rats were fed on basal diet (G_1).

Group(2): rats were fed on basal diet supplemented with 10% of Chipsy (tomato flavor) (G_2).

Group(3): rats were fed on basal diet supplemented with 10% of Doritos (sweet chili pepper) (G_3).

Group(4): rats were fed on basal diet supplemented with 10% of Windows (cheese flavor) (G_4).

Group(5): rats were fed on basal diet supplemented with 10% of Sunbites (cheese and herbs) (G_5).

Group(6): rats were fed on basal diet supplemented with 10% of Indomie(chicken curry flavor) (G_6).

During the experimental period (45 days), each rat was weighed every week and food consumption was recorded. The body weight gain (BWG) and food efficiency ratio (FER) were determined according to ***Chapman et al., (1959)*** using the following formula:

$$(\text{BWG}) = \frac{\text{Final Weight\_ Initial Weight}}{\text{Initial Weight}}$$

$$(\text{FER\%}) = \frac{\text{Daily body Weight gain(g)}}{\text{Food intake (g/d)}}$$

At the end of the experimental period (45days) rats were fasted over night before sacrificing, blood was collected then centrifuged. Serum was separated and stored at -20°c for biochemical analysis of serum total cholesterol (TC) and triglycerides (TG) ***Schettler and Nussel, (1975)*****,** high density lipoprotein cholesterol **(**HDL-c) ***Lope Virellaet al., (1977),*** low density lipoprotein cholesterol (LDL-c) and very low density lipoprotein cholesterol (VLDL-c) ***Fried wald et al., (1972),*** aspartate amino transferase (AST) and alanine amino transferase (ALT) ***Reitman and Frank el, (1957),*** serum alkaline phosphates (ALP) ***Belfield and Goldberg, (1971),*** uric acid ***Fossati et al., (1980),*** urea ***(Marsch et al.,1965)*** and Creatinine ***Bartels and Bohmer, (1971)*****.** Serum level of malondialdehyde (MDA) was assayed according to ***Draper and Hadley, (1990),*** serum superoxide dismutase (SOD) ***Kakkoret al.(1984),*** Total Antioxidant capacity (TAC) ***Woodford and Whitehead, (1998),*** serum immunoglobulin M (Igm), (Igg) and (IgE) ***Bartlet al.,(1998),Rivetzet al,(2009)*** and**Gonzalez-Quintelaet al,(1995**), respectively. Acetylcholinesterase (ACHE) ***Ellmanet al, (1961)***, Serotonin (ST) ***Bogdanski et al, (1956)*** and Dopamine (DA) ***Carlsson and Waldeck, (1958).*** Liver, kidneys and brain were separated from each rat and examined histopathologicaly.

Statistical analysis

The data was presented as means ± SD statistically analyzed using one way ANOVA test, $p<0.05$ was used to indicate significance ***Steel and Torri, (1980).***

Results and Discussion

On following the method of rapid assessment procedure we realized that the most commonly used junk foods by the majority of students were Chipsy,Doritos, Sun Bites, Windows and Indomie. So, these types of junk foods were chosen to supplement diet for rats to study their effect on the biological changes of rats.

Chemical composition of various types of junk food.Table (1)

The chemical composition of various types of junk food, moisture, protein, fat, ash, crude fiber and soluble carbohydrates are demonstrated in **Table(1).** The results showed that various types of junk food contain a high amount of fat and carbohydrates. Fat ranged from 19.09% to 30.78% and carbohydrates ranged from 49.26% to 61.54%.In contrast, various types of junk food contain a low amount of protein and fibers. This means that consumption of junk food may lead to overweight or obesity. This is supported by ***Mohammad beigi et al, (2018)*** who reported that fast food consumption is definitely related to overweight and obesity because of extremely high energy density of these foods.

Biological evaluation:

Junk food was subjected for animal biological experiment to study the effect of adding various types of junk food on the growth performance and measure the biochemical parameters compared to negative control rats after 45 day of feeding.

Food intake (FI), feed efficiency ratio (FER) and body weight gain (BWG) of rats that fed on various types of junk food.Table (2):

Table (2) showed that the mean value of food intake (g/day) ranged from 16.9 to 17.7 g, with no significant change in food intake among all tested diets.Also, after feeding, the experimental animal with different tested diets for 45 days, the rats of BWG (g/day) was calculated and the results are shown in Table (3). This table shows an increase in the means of FER and BWG in all groups compared to the control group although the increase was not significant.This result agrees with that of ***(Soltan and Shehata, 2012).***

Kidney function of rats that fed on various types of junk food.Table (3):

The obtained results in **Table(3)** showed a marked significant increase in serum creatinine(Cr), urea, uric acide(U.A) levels in (G_2, G_3, G_4, G_5 and G_6) compared to those of the control group G_1,except G_5 in serum(U.A), which nearly returned toward the normal level. The highest values in serum (Cr) and (U.A) were in G_3 and the highest value in urea was in G_4, followed by groups G_4 in serum (Cr), G_5in serum Cr & urea, G_6 in serum (U.A), then G_2 in serum urea & U.A and G_4 in serum U.A, respectively. The present result was in accordance with ***Bayol et al., (2009)*** who showed that cholesterol and salt in a chain are used to assess blood pressure, stroke, and heart disease. Excessive salts can also affect kidney function. Another study, confirmed that high sodium levels have specifically been identified as the causative factor of high blood pressure. Sodium is known to affect the renin-angiotensin process in the kidneys, resulting in vasoconstrictive effects on arterioles, resulting in high blood pressure production. The salts used for the preparation also have an effect on their excretion through the renal system ***(Ashakiran and Deepthi, 2012).***

Liver enzymes of rats that fed on various types of junk food.Table(4):

Table(4) shows a marked significant increase in serum of Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and Alkaline phosphatase (ALP) in groups (2, 3, 4, 5, 6) compared with the control G_1(-) except group(5) in serum(ALP) which nearly returned toward the normal level. On the other hand, the worst results in serum ALT, AST and ALP had G_3, G_6 as well as G_4 in serum ALT, AST and G_2 in serum ALT. Followed by groups G_2 in serum AST and ALP G_4 in serum (ALP) G_5 in serum (ALT) and (AST), respectively. These results are agreement with ***(Oyedepo et al., 2016)*** who reported that junk foods should be consumed with caution because of the risk that their consumptionleads to hyper-nutrition that poses a danger to consumers, rising liver marker enzymes and can affect the liver function. Additionally, ***(Erik-Keough, (2018)*** reported that junk foods have strong ties to obesity in both adults and children. Obesity is one of the main causes of disease burdens that can be prevented.Obesity in children may be correlated with adult obesity, insulin resistance, type 2 diabetes mellitus, metabolic syndrome, cardiac, orthopedic, neurological, hepatic, pulmonary and renal disorders.

Brain enzymes of rats that fed on various types of junk food.Table (5):

Table (5) showed that groups (G_2, G_3, G_4, G_5, G_6) rats have a significant decrease in serum levels of Acetylcholinesterase (ACHE), Dopamine (DA) and Serotonin (ST) compared with those ofcontrol group. Additionally, the group which fed on supplemented diet with doritos sweet chili pepper or windows cheese flavor or indomie chicken curry flavor had the worst groups in serum ACHE,DA and ST. Followed by group which fed on supplemented diet with chipsy tomato flavor and sunbites cheese & herbs flavor. The present result was in accordance with ***(Bandini et al.,1999)*** who showed that combined fat and sugar may create a dopamine-driven rush of intense pleasure in people with an addictive behavior tendency. On the other hand, it should be remembered that they are also dangerous to health. ***(Jeffery et al., 2009)*** confirmed that Junk foods can cause chemical reactions in the brain, which ultimately lead to depression**.** Additionally, ***(Valencia-Sanchez et al., 1997)*** reported that dopamine and serotonin increased significantly in the intake of potato chips plus ketchup. This could be due to the inclusion of lycopene in ketchup, which could reduce ACR toxicity. ***Sapna-(Johnson et al., 2012)*** also found that excessive junk food intake led to decreased in striatum activity, a portion of the forebrain which tracks reward. In other words, as with drugs junk food addicts need ever-increasing amounts of it to get the same "high". Researchers identified a correlation in the development of dopamine between drug addicts and junk food users in a correlative analysis. Addiction to either ultimately causes dopamine-signaled brain receptors to lose their sensitivity. As a result, addicts need increasing amounts of the addictive substance to be fulfilled at the same rate.

Lipid profile of rats that fed on various types of junk food.Table (6):

The obtained results in **Table (6)** showed a marked significant increase in serum total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol(LDL-c) and very low density lipoprotein cholesterol(VLDL-c) levels and significant decrease in serum high density lipoprotein cholesterol(HDL-c) levels in groups (G_2, G_3, G_4 and G_6) compared with those of the control group. The worst results were in serum TC, TG, LDL-c and VLDL in G_3 and in serum TG, VLDL-c had G_2, G_4 and G_6. Followed by group G_2 in serum TC &LDL-c, G_2, G_3, G_4, G_5&G_6 in serum HDL-c follow them G_4 in serum TC and LDL-c. Results of the present study agree with ***(Geeta-Arya and Sunita-Mishra, 2013)*** who clarified that eating fast food and leading to a sedentary lifestyle leads to obesity and other complications such as increased cholesterol levels, blocking out of the arteries, increased risk of coronary disease, as well as general physical discomfort due to the extra weight. They also stated that the consequences of junk food include nutritional deficiencies, obesity, increased levels of cholesterol, heart problems and many other threats to health. ***(Jagadish,2015)*** reported that junk food consumption

is responsible for obesity, hypertension, dyslipidemia, heart disease and diabetes. Another study by ***Bayolet al., (2008)*** revealed that mothers who eat junk food during pregnancy and breast-feeding have infants that are more likely to become obese. The kids are also more vulnerable to diabetes and elevated lipid profile.

Malondialdehyde, Total Antioxidant Capacity and Superoxide Dimutase serum of rats that fed on various types of junk food.Table (7):

Malondialdehyde serum (MDA.S) value of the control group rats was 30.75±4.57 nmol/ml, while the rats groups that fed on various types of junk food as Chipsy (G_2), Doritos (G_3), Windows (G_4), Sun Bites (G_5) and Indomie (G_6) recorded 42.13±2.59,100.25±20.84, 51.63±5.96, 45.75±4.99 and 63.5±3.70nmol/ml, respectively. These results show that there is a high significant difference of MDA.S values between the experimental groups compared to the control group. The worst group was G_3 followed by G_6 then G_4, G_5 and G_2 respectively. This means that eating junk food for a long time may increase the level of Malondialdehyde. This compound is a reactive aldehyde and is used as biomarker to measure the level of oxidative stress in organism.

Total Antioxidant Capacity serum (TAC.S) value of the control group rats was 17.75±2.63ng/ml, while the rats groups that fed on various types of junk food as Chipsy (G_2), Doritos (G_3), Windows (G_4), Sun Bites (G_5) and Indomie (G_6) recorded 17.56±0.66, 8.13±1.65, 12.5±1.08, 14.75±1.04 and 12.63±0.78ng/ml, respectively.

These results demonstrate that there is a significant decrease of TAC.S values among the experimental groups compared to the control group. The least value of TAC.S was G_3 followed by G_6, G_4 and G_5. This shows that eating junk food reduces TAC.

Superoxide Dimutase serum (SOD.S) value of the control group rats was 34.13±1.55 U/ml, whereas the rats groups that fed on various types of junk food as Chipsy (G_2), Doritos (G_3), Windows (G_4), Sun Bites (G_5) and Indomie (G_6) recorded31.38±0.32, 14.63±1.89, 23.81± 4.44, 28.63± 1.49 and 21.63±3.90 U/ml, respectively.These results demonstrate that there is a significant difference of SOD.S values between the experimental groups compared to the control group. The least value of SOD.S was G_3 followed by G_6, G_4 and G_5. However, G_2 was the nearest to the control group. This means that consumption of junk food reduces SOD.S values. ***(Prased and Muralidhara,2012)*** found that there is evidence of increased development of free radicals and hydroperoxides in animals exposed to acrylamide followed by lipid peroxidation. Also ***(Yousef and El-Demerdash,2006)*** said that increased SOD production in blood plasma, liver, testes, kidneys and the brain of acrylamide-exposed rats**.**

Immunoglobulin serum of rats that fed on various types of junk food.Table (8):

Immunoglobulin M serum (IGM.S) value of the control group rats was 12.13±3.33ng/ml, while the rats groups that fed on various types of junk food as Chipsy (G_2), Doritos (G_3), Windows (G_4), Sun Bites (G_5) and Indomie (G_6) recorded 22.5±4.04, 70.25±23.41, 43.5±23, 15.75±4.99 and 53.75±12.34 ng/ml, respectively.

These results show that there is a significant increase in IGM.S value between the experimental groups compared to negative control group. The highest value of IGM.S was G_3 followed by G_6, G_4 and G_2.

Immunoglobulin E serum (IGE.S) value of the control group rats was 7.97±4.13ng/ml, whereas the rats groups that fed on various types of junk food as Chipsy (G_2), Doritos (G_3), Windows

(G_4), Sun Bites (G_5) and Indomie (G_6) recorded 34.00±8.60, 36.00±6.68, 61.5±9.88, 13.38±3.09 and 87.75±13.67ng/ml, respectively.

These results reveal that there is a significant increase in IGE.S values between the experimental groups compared to negative control group. The highest value of IGE.S was G_6, followed by G_4 then G_3, G_2 and G_5.

Immunoglobulin G serum (IGG.S) value of the control group rats was 37.25±10.28 ng/ml, meanwhile the rats groups that fed on various types of junk food as Chipsy (G_2), Doritos (G_3), Windows (G_4), Sun Bites (G_5) and Indomie (G_6) recorded65.57± 4.99, 150.75±40.61, 67.5± 15.15,46.25± 13.94 and 123.75±17.97ng/ml, respectively.

These results show that there is a significant increase in IGG.S values among the experimental groups compared to control group. The highest value of IGE.S was G_3, followed by G_6 then G_4, G_2 and G_5. This means that consumption of junk food leads to grow a strong inflammatory reaction throughout the body as if it had been diseased with dangerous bacteria. This suggests that junk food can make the body produce a huge and powerful army of immune cells.These results agree with the study of ***(Pountoukaet al., 2010*)** in which they stated that the influence of coloring foods on the body's immunity and histology organs in rats as well as most research on the determination of coloring agents in foods and the effect of specific coloring concentrations on biochemical blood analysis.

Histopathological Examinations

Histopathological examination of kidneys:

Microscopically, kidneys of rats from group1 (control group) revealed the normal histological structure of renal tissue **(Figs.1).** On the other hand, Kidneys of rats from group2 fed on chipsy tomato flavor showed vacuolar degeneration of epithelial lining renal tubules **(Fig.2)** and proteinaceous material in the lumen of some renal tubules. Kidneys from group 3 fed on doritos sweet chili pepper revealed necrobiosis of epithelial lining renal tubules with perivascular inflammatory cells infiltration **(Fig.3).** Meanwhile, section from group 4 fed on windows cheese flavor showed mild histopathological changes described as slight congestion of renal blood vessels and glomerular tufts **(Fig.4).** Moreover, kidneys from group 5 fed on sun bites cheese and herbs flavor revealed no histopathological changes **(Fig.5).**Moreover, kidneys from group 6 fed on indomie chicken curry flavor revealed vacuolar degeneration of epithelial lining renal tubules, congestion of glomerular tuft and distension of Bowman's space **(Figs.6).**These results agree with ***SoltanandShehata, (2012)*** who reported that Changes in the histological architecture of the liver and kidney are revealed in color foods. In addition, the use of artificial colors in different foods adversely affects certain biochemical analyzes; and the histopathological composition of the liver and kidneys**.**

Histopathological examination of liver:

Microscopically, liver of rats from group 1 (control group)revealed the normal histological structure of hepatic lobule **(Figs. 1).**On the other hand, liver of rats from group 2 that fed on chipsy tomato flavor revealed slight vacuolation of some hepatocytes **(Figs. 2).** Meanwhile, liver from group 3 that fed on doritos sweet chili pepper showed vacuolar degeneration of hepatocytes and portal infiltration with inflammatory cells **(Fig.3).**Moreover, liver of rats from group 4 that fed on windows cheese flavor revealed vacuolar degeneration of hepatocytes **(Fig.4).** Examined sections from group 5 that fed on sun bites cheese revealed no histopathological changes **(Fig.5).** However, liver from group 6 that fed on indomie chicken curry flavor revealed vacuolar degeneration of hepatocytes **(Fig. 6)**.

According to ***Sharma et al., (2008*)** these results indicate that artificial color has an adverse effect on vital organ. The liver showed a disturbance of hepatic cells near the central vein at low dose synthetic color and impaired hepatocellular cells. Also,***Zhu et al.,(2008)*** who reported that high cholesterol from junk food also has a long-term impact on the liver where it is metabolized as its liver travels and gradually destroys it. This may be due to the presence of acrylamide produced at high temperature during fried potato chips. Acrylamide has shown hepatocyte cell damage in rats***Tarekeet al.,(2002).***These findings agree with ***El-Sayyadet al., (2011)***study,who claimed that acrylamide showed liver-characterized histological abnormalities.

Histopathological examination of brain:

Microscopically, some brain parts (cerebral cortex) of rats from group 1 (control group) revealed no histopathological changes **(Figs. 1).** Meanwhile, brain of rats from groups 2 fed on chipsy tomato flavor showed no histopathological alterations **(Figs. 2)** except groups 3 fed on doritos sweet chili pepper atrophy, necrosis and pyknosis of some neurons in some sections **(Figs. 3).** However, brain of rats from group 4 fed on windows cheese flavor revealed neuronal oedema as well as atrophy, necrosis and pyknosis of some neurons **(Figs. 4).** Meanwhile, sections from group 5 fed on sun bites cheese revealed no histopathological alterations **(Figs. 5).** On the other hand, brain of rats from group 6 fed on indomie chicken curry flavor showedatrophy, necrosis and pyknosis of some neurons as well as neuronophagia of necrotic neurons **(Fig. 6).**Results of the present study agree with ***(Bayolet al., 2009)*** who demonstrated that Junk food eating over a period of time can decrease blood circulation due to accumulation of fat. In general, the lack of essential oxygen, nutrients and proteins can temporarily stain the gray matter of the brain cells. Also ***Zhuet al., (2008)*** said that In general, the lack of vital oxygen, nutrients and proteins could temporarily damage the gray matter of the brain cells.

Conclusion

Junk food have been found to contain a high percentage of fat and tend to be useless or of low nutritional value. Consumption of junk food also leads to different health problems and causes many of the harmful effects on the body, especially in children such as obesity, impaired immunity, increased lipid profile in the blood, kidney function, liver enzymes, immunoglobulin serum and bad effect on brain enzymes and total antioxidant**.**

Recommendations

The study recommends that the junk foods should be avoided because of their bad effects on health. It also recommends that analysis of the preservatives, additives and colors to be done in these foods in other research as it was difficult to analyze them in the current study.

Table (1)

Chemical composition of various types of junk food

Content (%) / Types of junk food	Moisture	Protein	Fat	Fiber	Ash	Soluble Carbohydrates	Total
Chipsy (Tomato flavor)	3.06	8.38	30.78	4.84	3.54	49.40	100
Doritos (Sweet chili pepper)	3.32	8.70	24.29	4.21	2.60	56.88	100
Windows (Cheese flavor)	4.90	6.33	23.17	1.44	2.62	61.54	100
Sun bites (Cheese and herbs flavor)	4.72	12.85	28.28	1.95	2.94	49.26	100
Indomie (Chicken curry flavor)	5.37	10.11	19.09	1.69	3.38	60.36	100

Table (2)

Food intake (FI), feed efficiency ratio (FER) and body weight gain (BWG) of rats fed on various types of junk food

Parameters / Groups	FI (g/day) (Mean±S.D)	FER (%) (Mean±S.D)	BWG (g) (Mean±S.D)
(G_1) Control	17.26±1.06 [a]	18.05±1.82 [a]	2.08± 0.188 [a]
(G_2) Chipsy (Tomato flavor)	17.7±0.98 [a]	19.72±1.05 [a]	2.32± 0.271 [a]
(G_3) Doritos (Sweet chili pepper)	17.56±0.59 [a]	19.72±2.50 [a]	2.39±0.505 [a]
(G_4) Windows (Cheese flavor)	17.26±0.96 [a]	18.18±1.29 [a]	2.09± 0.255 [a]
(G_5) Sun bites (Cheese and herbs flavor)	16.9±1.07 [a]	19.58±2.39 [a]	2.23± 0.342 [a]
(G_6) Indomie (Chicken curry flavor)	17.4±0.92 [a]	19.01±1.50 [a]	2.27±0.184 [a]
LSD	1.23	2.40	0.406

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table (3)

Kidney function of rats fed on various types of junk food.

Parameters / Groups	Creatinine(mg/dl) (Mean±S.D)	Urea(mg/dl) (Mean±S.D)	Uric acid(mg/dl) (Mean±S.D)
(G_1) Control	0.61±0.06 ^{C}	29.21±8.25 ^{e}	3.30± 0.26 ^{d}
(G_2) Chipsy (Tomato flavor)	0.75±0.05 ^{ab}	45.43±5.17 ^{cd}	4.54± 0.47 ^{c}
(G_3) Doritos (Sweet chili pepper)	0.85±0.05 ^{a}	56.89±5.59 ^{ab}	6.58±0.46 ^{a}
(G_4) Windows(Cheese flavor)	0.72±0.06 ^{b}	62.1±8.03 ^{a}	4.24± 0.20 ^{c}
(G_5) Sunbites(Cheese and herbs flavor)	0.65±0.05 ^{bc}	50.18±2.17^{bc}	3.53± 0.22 ^{d}
(G_6) Indomie (Chicken curry flavor)	0.84±0.07 ^{a}	36.84±3.67 ^{de}	5.66±0.32 ^{b}
LSD	0.086	8.76	0.505

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table(4)

Liver enzymes of rats fed on various types of junk food.

Parameters / Groups	ALT(U/L) (Mean±S.D)	AST(U/L) (Mean±S.D)	ALP(U/L) (Mean±S.D)
(G_1) Control	43.74±5.62 ^{C}	109.14±13.69 ^{c}	143.36± 5.92 ^{c}
(G_2) Chipsy(Tomato flavor)	69.45±10.47 ^{ab}	142.76±7.12 ^{b}	167.61± 18.31 ^{b}
(G_3) Doritos(Sweet chili pepper)	89.92±17.63 ^{a}	185.79±10.87 ^{a}	210.8±12.09 ^{a}
(G_4) Windows(Cheese flavor)	69.64±9.16 ^{ab}	166.63±10.22 ^{a}	169.75± 12.45 ^{b}
(G_5) Sunbites(Cheese and herbs flavor)	55.79±7.44 ^{bc}	138.46±9.93 ^{b}	147.80± 8.57 ^{c}
(G_6) Indomie(Chicken curry flavor)	73.61±6.92^{ab}	180.37±18.82 ^{a}	198.57±9.32 ^{a}
LSD	15.33	18.33	17.49

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table (5)

Brain enzymes of rats fed on various types of junk food.

Parameters / Groups	ACHE(pg/ml) (Mean±S.D)	Dopamin(ng/ml) (Mean±S.D)	Serotonin(ng/ml) (Mean±S.D)
(G_1) Control	92.25±5.32 [a]	2.025±0.33 [a]	29.25± 5.74 [a]
(G_2) Chipsy(Tomato flavor)	68.25±11.53 [b]	1.288±0.25 [b]	20.25± 2.60 [b]
(G_3) Doritos(Sweet chili pepper)	28.38±5.79 [c]	0.674±0.09 [c]	12.13±1.56 [c]
(G_4) Windows(Cheese flavor)	40.38±8.44 [c]	0.823±0.06 [c]	14.33± 1.81 [c]
(G_5) Sunbites(Cheese and herbs flavor)	67.25±15.63 [b]	1.210±0.23 [b]	19.48± 2.68 [b]
(G_6) Indomie(Chicken curry flavor)	37.5±10.41 [c]	0.769±0.14 [c]	12.69±2.63 [c]
LSD	15.08	0.31	4.68

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table (6)

Lipid profile of rats fed on various types of junk food.

arameters / Groups	T.C(mg/dl) (Mean±S.D)	T.G(mg/dl) (Mean±S.D)	HDL(mg/dl) (Mean±S.D)	LDL(mg/dl) (Mean±S.D)	VLDL(mg/dl) (Mean±S.D)
(G_1) Control	82.55±4.97 [d]	71±3.11 [b]	52.74±1.91 [a]	15.60±4.94 [d]	14.20± 0.62 [b]
(G_2) Chipsy(Tomato flavor)	121.08±12.18 [b]	85.60±5.92 [a]	47.04±1.15 [b]	56.91±11.35 [b]	17.12± 1.19 [a]
(G_3) Doritos (Sweet chili pepper)	158.59±13.67 [a]	93.44±5.35 [a]	49.16±0.89 [b]	90.75±12.58 [a]	18.69±1.07 [a]
(G_4) Windows (Cheese flavor)	103.35±6.56 [c]	89.63±2.22 [a]	50.49±1.05 [ab]	34.93±7.32 [c]	17.92± 0.44 [a]
(G_5) Sunbites (Cheese and herbs flavor)	84.97±6.47 [d]	75.92±5.48 [b]	47.95±1.75 [b]	21.83±5.68 [cd]	15.18± 1.09 [b]
(G_6) Indomie (Chicken curry flavor)	90.04±12.09 [cd]	84.51±6.92 [a]	46.89±3.09 [b]	27.69±10.30 [cd]	16.9±1.38 [a]
LSD	14.17	7.58	2.68	13.61	1.52

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table (7)

Malondialdehyde, Total Antioxidant Capacity and Superoxide Dimutase serum of rats fed on various types of junk food.

Parameters / Groups	MDA(nmol/ml) (Mean±S.D)	TAC(ng/ml) (Mean±S.D)	SOD(U/ml) (Mean±S.D)
(G_1) Control	30.75±4.57 ^{d}	17.75±2.63 ^{a}	34.13± 1.55 ^{a}
(G_2) Chipsy(Tomato flavor)	42.13±2.59 ^{cd}	17.56±0.66 ^{a}	31.38± 0.32 ^{ab}
(G_3) Doritos(Sweet chili pepper)	100.25±20.84 ^{a}	8.13±1.65 ^{c}	14.63±1.89 ^{d}
(G_4) Windows(Cheese flavor	51.63±5.96 ^{bc}	12.5±1.08 ^{b}	23.81± 4.44 ^{c}
(G_5) Sun bites(Cheese and herbs flavor)	45.75±4.99 ^{cd}	14.75±1.04 ^{b}	28.63± 1.49 ^{b}
(G_6) Indomie(Chicken curry flavor)	63.5±3.70 ^{b}	12.63±0.78 ^{b}	21.63±3.90 ^{c}
LSD	14.04	2.18	3.99

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table (8)

Immunoglobulin serum of rats fed on various types of junk food.

Parameters / Groups	IGM (ng/ml) (Mean±S.D)	IGE (ng/ml) (Mean±S.D)	IGG (ng/ml) (Mean±S.D)
(G_1) Control	12.13±3.33 ^{d}	7.97±4.13 ^{d}	37.25± 10.28 ^{b}
(G_2) Chipsy(Tomato flavor)	22.5±4.04 ^{cd}	34.00±8.60 ^{c}	65.57± 4.99 ^{b}
(G_3) Doritos(Sweet chili pepper)	70.25±23.41 ^{a}	36.00±6.68 ^{c}	150.75±40.61 ^{a}
(G_4) Windows(Cheese flavor)	43.5±23 ^{bc}	61.5±9.88 ^{b}	67.5± 15.15 ^{b}
(G_5) Sun bites(Cheese and herbs flavor)	15.75±4.99 ^{d}	13.38±3.09 ^{d}	46.25± 13.94 ^{b}
(G_6) Indomie(Chicken curry flavor)	53.75±12.34^{ab}	87.75±13.67 ^{a}	123.75±17.97 ^{a}
LSD	21.71	12.57	30.48

Values are expressed as means ± SD.

Values at the same column with different letters are significant at P<0.05.

Table (9)

Sectional survey of various types of junk food

junk food	The consumption per day			
	Once	Twice	Three times	Scarcely
Chipsy				
Crunchy				
Tiger				
Kono				
Flamenco				
Sun Bites				
Beck Rolls				
Beck Steak				
Doritos				
Qalbaz				
Windows				
Faraqelawz				
Cheetos				
Break				
Indomie				

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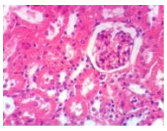
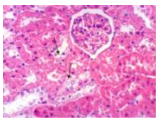
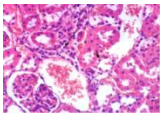
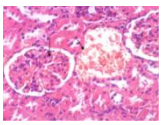
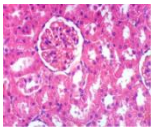
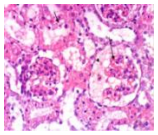
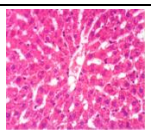
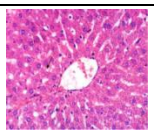
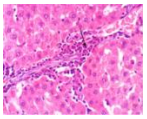
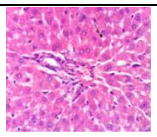
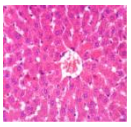
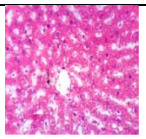
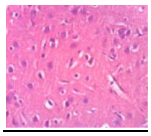
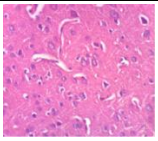
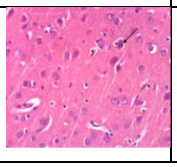
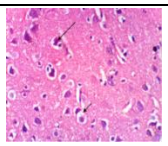
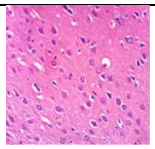
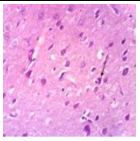
	(G_1) Control	(G_2) Chipsy (Tomato flavor)	(G_3) Doritos (Sweet chili pepper)	(G_4) Windows (Cheese flavor)	(G_5) Sun Bites (Cheese and herbs flavor)	(G_6) Indomie (Chicken curry flavor)
	Fig. (1)	Fig. (2)	Fig. (3)	Fig. (4)	Fig. (5)	Fig. (6)
kidney						
liver						
brain						

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تأثير بعض الأغذية السريعة المنتشرة بين طلاب المدارس على التغيرات البيولوجية فى الجرذان

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الملخص العربى

إجريت الدراسة الحالية لفحص تأثير تناول أنواع مختلفة من الوجبات السريعة التى يكثر إستخدامها من قبل تلاميذ المرحلة الإبتدائية والإعدادية على الصحة العامة. وتم دراسة تأثير ذلك بأستخدام ثلاثين من الجرذان من نوع الالبين وتتراوح أوزانهم من (70 ±10 جرام) لمدة 45 يوم. قسمت الجرذان إلى 6 مجموعات بواقع 5 جرذان فى المجموعة.

المجموعة الأولى : مجموعة ضابطة سالبة تغذت على الغذاء الأساسى فقط والماء طول فترة التجربة.
المجموعة الثانية : تغذت على الغذاءالأساسى المضاف له 10% من مسحوق الشيبسى.
المجموعة الثالثة : تغذت على الغذاءالأساسى المضاف له 10% من مسحوق الدوريتوس.
المجموعة الرابعة : تغذ تعلى الغذاءالأساسى المضاف له 10% منمسحوق الويندوز.
المجموعة الخامسة : تغذت على الغذاءالأساسى المضاف له 10% من مسحوق الصن بايتس.
المجموعة السادسة : تغذت على الغذاءالأساسى المضاف له 10% من مسحوق الإندومى.

وقد أشارت النتائج إلى إرتفاع محتوى الوجبات السريعة من الدهون والكربوهيدرات وإنخفاض محتواه من البروتين والألياف. بالإضافة إلى تأثيرها السيئ على كل من إنزيمات الكبد, وظائف الكلى, جلوبيولينات المناعة, إنزيمات المخ, المستوى الكلى لمضادات الأكسدة ودهون الدم. كما وضحت النتائج هناك زيادة في نسبة كفاءة التغذية وزيادة وزن الجسم في جميع المجموعات مقارنة بمجموعة التحكم على الرغم من أن الزياد لم تكن ذات دلالة إحصائية. واستنتج الباحثون إلى أن تناول الوجبات السريعة له تأثيرسيئ على الصحة وقد يؤدي إلى الكثيرمن الأمراض،خاصة لطلاب المدارس. نوصي بإجراء مزيد من الدراسات لاكتشاف أنواع الإضافات الغذائية.