

The Possible Protective role of Ginseng on growth performance induced experimentally by Bisphenol A- in adult male rabbits

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Abstract Bisphenol A (BPA) is a chemical material that because of its positive characteristics is used in polycarbonate plastic and epoxy resins. Ginseng extracts are good anti-oxidant. This study was carried out to investigate the possible anti-oxidant activity of ginseng extract on the BPA-induced effect on growth performance of adult rabbit. Twenty male New Zealand White rabbits were randomly divided into four groups: (1): control group; (2): rabbits were treated with ginseng alone (3): rabbits were treated with BPA and (4): rabbits were given BPA and ginseng. The changes in body weight (BW), feed intake (FI) and drinking water throughout the 12-week experimental period. Wight of some organs includes liver, lung, heart, kidney and brain were measured. Rabbits treated with Ginseng, BPA overall means indicated that treatment with BPA caused significant decrease in BW, FI and drinking water compared to control animals. Ginseng alone was caused significantly increasing on BW, FI and drinking water. A similar observation was noticed with a weight of organs in different treated groups. The presence of ginseng with BPA caused a significant increase in the reduction of BW, FI, drinking water and weight of organs due to treatment with BPA, and this means that ginseng alleviated its toxicity.

Keywords: Ginseng, Bisphenol A (BPA), feed intake, body weight and organs weight.

الدور الوقائي الممكن للجينسنغ على أداء النمو الناتج تجريبيا بثنائي الفينول A- في ذكور الأرانب البالغين

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المخلص بيسفينول A هو مادة كيميائية التي بسبب خصائصها الكيميائية يستخدم في البلاستيك متعدد الكربونات مستخلص الجينسنغ يعتبر مضاد للأكسدة. أجريت هذه الدراسة للتحقيق في النشاط المضاد للأكسدة الممكن من مستخلص الجينسنغ على التأثير المحدث بالبيسفينول A التي يسببه على أداء النمو في ذكور الأرانب. النيوزلندية البيضاء . تم تقسيم الارانب العشرين عشوائيا إلى أربع مجموعات: (1): مجموعة السيطرة؛ (2): تم معاملة الارانب بمستخلص الجينسنغ وحده (3): تم معاملة الأرانب بالبيسفينول (4): أعطيت الأرانب البيسفينول ومستخلص الجينسنغ تم قياس التغيرات في وزن الجسم و تناول العلف ومياه الشرب طوال فترة التجربة والتي مدتها 12 أسبوعا. ايضا تم قياس وزن بعض الأعضاء تشمل الكبد والرئة والقلب والكلى والدماغ.في نهاية التجربة. الأرانب المعاملة مع البيسفينول لوحظ انخفاض كبير في وزن الجسم ومياه الشرب بالمقارنة مع الحيوانات السيطرة. الجينسنغ وحده تسبب زيادة كبيرة في وزن الجسم ومياه الشرب. المجموعة الرابعة نتائجها مماثلة لمجموعة السيطرة. نتيجة مماثلة لوحظت مع اوزان الاعضاء في مجموعات المعالجة المختلفة. وجود الجينسنغ مع بالبيسفينول تسبب زيادة كبيرة في الحد من نقص وزن الجسم ومياه الشرب ووزن الأعضاء وهذا يعني أن الجينسنغ له دور في تخفيف سمية البيسفينول.

الكلمات المفتاحية: الجينسنغ ، بيسفينول A ، تناول العلف، وزن الجسم ووزن الاعضاء.

Introduction

Bisphenol A or 2,2 bis (4-hydroxyphenyl) propane is a high chemical production volume used in a variety of common consumer products since 1957. It is used as the monomer to manufacture polycarbonate plastic, the resin that lines most food and beverage cans, dental sealants, and as an additive in other plastics [1]. BPA is one of the highest volume chemicals produced worldwide; global BPA production capacity in 2003 was 2.2 million metric tons (over 6.4 billion pounds), with a 6-10% growth in demand expected per year [2].

It is also present in polycarbonate plastics, the epoxy resin liners of aluminium cans, and thermal receipts [3]. Polycarbonates are used in plastic containers commonly used in the food industry and at home, such as plastic bottles, lenses, and medical devices [4]. The major human exposure route to BPA is diet, including ingestion of contaminated food and water [5]. Therefore, due to the potential impact on health, in Japan epoxy coating was replaced by a polyester film [4]. BPA is a chemical switch in endocrine processes, and

it may impact reproduction, weight, and development. It acts like a hormone, altering cellular function at very low concentrations, with the maximum safe levels of 5mg/kg/day [6]. There is extensive evidence for “programming” effects of BPA on the subsequent activity of enzymes in tissues and thus metabolic processes. An increase in the postnatal growth rate due to developmental exposure to low doses of BPA has been shown in many studies [7]. In previous review, sixteen oral and nine non-oral studies in rats measured effects of low doses of BPA on body weight [8]. The few statistically significant results reported had no internal consistency across time points, no dose response, and are not corroborated, in that most studies show no effects [8]. Other study with adult BPA exposure reported changes in body weight due to exposure at doses ≤ 5 mg/kg-d [9], [10], [11] and [12].

Ginseng (*Panax ginseng* C.A. Meyer) roots have long been used as a traditional medicine in Asian countries for preventive and therapeutic purposes. Ginseng has immune-modulatory [13], anti-tumor [14], antioxidant, and glucose-lowering activities [15]. Most published biochemical and pharmacological studies have reported ginsenosides as the main bioactive constituents of ginseng. Polyacetylene and phenolic compounds, such as maltol, have attracted attention due to their antioxidant activities [16]. The pharmacological effects of ginseng can be understood in the light of their polyvalent actions as demonstrated by ginseng saponins with their positive anti- mutagenic, anticancer, protective action against mammalian tumors cell lines, anti-diabetes [17]. Various studies have suggested that saponins and polysaccharides from ginseng could enhance immunity in vitro and perform a variety of functions, including immune- modulation, anti-tumor and anti- oxidant activities [18]. The reasons for the increased egg production is likely to be the improved health status of birds fed on diets supplemented with ginseng adventitious root meal. Two studies showed that ginseng berry extracts exhibit potent anti-hyperglycemic and anti-obesity effects in obese animal models [19] and [20]. Previous study showed that a wild ginseng ethanol extract had preventive effects against diabetes and obesity [21]. The purpose of the current study was to find out the effect of extract of ginseng on body/organs weight induced experimentally by BPA in male rabbits.

Materials and Methods

Mature male New Zealand White rabbits (age of 7 months and initial weight of 2.917 ± 28.9 Kg) were used. Animals were individually housed in cages and weighed weekly throughout 3-months experimental period. Twenty four mature male rabbits were randomly divided into four equal groups (each five rabbits). The first group was used as control. The second group was used to study the effect of BPA (500 mg/kg body weight) and the third group was used to study the effect of Ginseng 100 mg/kg body weight which dissolved in corn oil). The fourth group was used to study the effect of BPA plus ginseng. The doses of the

BPA and ginseng were calculated according to the animal's body weight on the week before dosing. The proper doses of BPA and ginseng for each animal were placed into a syringe that was inserted orally with the help of plastic tube inserted directly into the oesopharyngeal region. The tested doses of BPA and ginseng were given daily for 12 week.

Body weight, feed intake, drinking water and organs weight

Body weight of each animal was recorded weekly throughout the 12-week of the experimental period. The weight measurements were carried out in the morning before access to feed and water. Daily feed and water intakes were recorded weekly for each group. At the end of treatment period, all animals of each group were slaughtered. Weights of liver, kidney, heart, brain, lung and heart were also recorded (the organs were weighed after blotting them dry). These organs were individually identified and kept frozen (-20°C) until assays performed. After complete bleeding the pelt, viscera and tail were soon removed and dressing weight was recorded.

Results

The changes in body weight (BW), feed intake (FI) and drinking water throughout the 12-week experimental period of rabbits treated with ginseng, BPA and their combination were summarized in (Table 1) represents the weekly mean values of these parameters expressed as absolute values. Over all means indicated that treatment with BPA caused significant ($P < 0.05$) decrease in BW, FI and drinking water compared to control animals. Ginseng alone significantly ($P < 0.05$) increased on BW, FI and drinking water. The presence of ginseng with BPA caused significant increase in the reduction of BW, FI and drinking water due to treatment with (BPA), and this means that ginseng alleviated its toxicity. The changes in different weight of organs include liver, heart, brain, kidney and lung at end of period of experiment of four groups were presented as mean values in Table 2. No deference were noticed between group treated with ginseng alone and control group in term of weighting organs (liver, brain, kidney heart and lungs). They were increased weight of organs in third group comparison with control except heart was decreased. In combination group, weight of organs were been similar to control.

Table 1: Average of body weight (gm), feed intake (gm/kg body weight/day) and drinking water (ml/kg body weight/day) in male rabbits treated with Ginseng, PBA and/or their combination.

Parameters	Groups			
	Control	Ginseng	BPA	Ginseng + BPA
Body weight	3028 \pm 25 ^b	3577 \pm 78 ^a	2539 \pm 47 ^d	2906 \pm 25 ^c
Feed intake	50 \pm 0.44 ^b	60 \pm 0.50 ^a	40 \pm 0.94 ^d	47 \pm 0.42 ^c
Drinking water	51.9 \pm 0.62 ^b	54.3 \pm 0.8 ^a	43 \pm 1.01 ^c	49.9 \pm 0.6 ^b

^{abcd} Within row overall mean with different superscript letter differ significantly (P<0.05).

Table 2: Relative organs weights of brain, heart, liver, lung and kidney of male rabbits treated with ginseng, BPA and/or their combination (means \pm SE).

Organs	Groups			
	Control	Ginseng	BPA	Ginseng + BPA
Brain	0.210 \pm 0.006 ^c	0.220 \pm 0.004 ^c	0.277 \pm 0.01 ^a	0.249 \pm 0.005 ^b
Liver	2.10 \pm 0.05 ^c	2.15 \pm 0.06 ^c	3.14 \pm 0.04 ^a	2.50 \pm 0.06 ^b
Lung	0.382 \pm 0.04 ^b	0.369 \pm 0.04 ^b	0.480 \pm 0.03 ^a	0.43 \pm 0.02 ^{ab}
Heart	0.229 \pm 0.002 ^{ab}	0.239 \pm 0.008 ^a	0.203 \pm 0.003 ^c	0.221 \pm 0.001 ^b
Kidney	0.470 \pm 0.022 ^b	0.469 \pm 0.018 ^b	0.659 \pm 0.029 ^a	0.503 \pm 0.02 ^b

^{abcd} Means within rows with different superscript letters different Significantly (p<0.05).

Discussion

Concern is mounting regarding the human health and environmental effects of BPA, a high-production-volume chemical used in synthesis of plastics. We have designed this study to find out the protective effects of ginseng on BPA-induced growth performance in male rabbits. Our results were shown decreasing in couple parameters (FI and drinking water) with increasing body weight in group treated with BPA alone. These results agreeing with observation that found sporadic body weight increases in male rats given BPA orally between GD 7 and GD 17 depending on dose of BPA [22] and [23]. On other hand our results disagreeing with studies that found decreased body weight in response to developmental BPA exposures [24], [25] and [26]. Other studies were found no effects on body weight [27], [28] and [29]. Another research on the effect of the type of animal feed used in an experiment on postnatal growth suggests that whether or not an increase or decrease in body weight occurs may be related to the type of feed used [30]. Three parameters were found increased with ginseng alone and they were similar comparison to control in combination group. These results were agreed with study reported that ginsenosides present in the ginseng roots can potentially interact with growth and nutrient uptake in experimental animals [31]. From our results, Brain, liver, kidney and lung weigh were increased in ginseng and BPA treated groups, then back to normal weight in combination group, and this agreeing with study found that developmental exposure to BPA resulted in a significant change in the locus coeruleus in brain of rats [32] and [33], the increasing on liver and kidney weights in male rats were observed in couple studies with different doses of BPA [34] and [35]. Overall of our result body/organs weight are in line with the results of [36] in which the BW of rats increased significantly in the group treated with ginseng. Assessment of ginseng feeding on model animals also showed to modulate the body

weight and adipose tissue mass and can regulate energy metabolism in male animals [37], wherein FI was enhanced by ginseng supplementation in rats [36]. A possible explanation for increased aged rabbit's BW, FI and drinking water in the present study may be attributed to an improvement in nutrient utilization [38]. These results are consistent with [39], who found no significant effect on final BW in growing rabbits fed a dry extract of Siberian ginseng.

Conclusion

In conclusion, the present study showed that ginseng reduces the damaging effect of BPA on growth performance in male rabbits. Therefore, ginseng is thought to be relatively safe and chemo-preventive from BPA-related diseases. However, detailed studies are needed to confirm and study the mechanism of action of ginseng.

Arabic section:

Consent

It is not applicable.

Competing interest

Authors have declared that no competing interests exist

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