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Evaluation the role of peripheral histamine receptors (H_1 and H_2) in food and water intake in broiler chickens with satiation condition

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ABSTRACT

Histamine H1 and H2 receptors (H1-Rs) are found in peripheral tissues and in regions of the hypothalamus that are concerned with regulating body composition. This study was designed to evaluate the role of peripheral Histamine receptors (H1 and H2) in food and water intake in broiler chickens with satiation condition. Thirty –two broiler chickens weighing 700±50 gr were randomly divided in four groups (each group comprises 8 broilers) as groups: 1-Chlorpheniramine (Antagonist H1), 2- Phamotidine (Antagonist H2), 3-Histamine (Histamine-Dihydrochloride), 4-Control (Distilled water). Each broiler was individually put in separate metabolic cage for measurement of food and water intake. The animals were exposed to continuous light and the temperature of the first week of husbandry was ranged in 31-32^{0}C and then the temperature were decreased 2-3 ℃ every week so that in the time of experiment the temperature reached to 21-240C.In this period food and water were supplied in adlibitum. Our research indicates that Chlorpheniramine (Antagonist H1), Phamotidine (Antagonist H2) and Histamine-Dihydrochloride decreased food intake in most time bouts after injection compared to control group ($p<0.0001$). Also the result showed that Chlorpheniramine (Antagonist H1) decreased water drink (gr) in 180 min , 240 min, 300 min, 360 min, 420 min ,480 min , 540 min, 600 min, 660 min , 720 min, after injection compared to control group ($p<0.0001$) .Phamotidine (Antagonist H2) caused falling in water consumption in 360 min, 420 min, 480 min, 540 min, 600 min, 660 min, 720 min, 1260 min and 1380 min after the injection. ($p<0.0001$).

Key words: Histamine receptors, food and water intake, broiler, satiation

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INTRODUCTION

Controlling food intake and body weight is an issue of ever-growing importance because of the significant health consequences brought about by obesity. Obesity is associated with an increased risk of metabolic and cardiovascular conditions such as hypertension, dyslipidemia, diabetes mellitus, and obstructive sleep apnea. According to the World Health Organization, between 30 and 80% of adults and up to one-third of children in the World Health Organization's European region are overweight. Obesity's prevalence has tripled in many European countries since the 1980s, and the number of those affected continues to rise at an alarming rate. Obesity is already responsible for 2 to 8% of health costs and 10 to 13% of deaths in parts of Europe. Efficacious treatments of this condition are certainly among the greatest public health challenges of the 21st century. Interest in the histaminergic system as a potential target for the treatment of feeding disorders is driven by the unsatisfactory history of the pharmacotherapy of obesity. Eating behavior is regulated by a complex interplay of central neurotransmitter systems, peripheral endocrine stimuli, the circadian rhythm, and environmental cues, all factors that change the behavioral state and alter

homeostatic aspects of appetite and energy expenditure. The aim of present study was to investigate the role of peripheral H1 and H2 receptors in food and water intake in satiation condition in broiler chickens.

MATERIALS AND METHODS

Animals

Thirty –two broiler chickens weighing 700±50 gr were randomly divided in four groups (each group comprises 8 broilers) as groups: 1-Chlorpheniramine (Antagonist H1), 2- Phamotidine (Antagonist H2), 3-Histamine (Histamine-Dihydrochloride), 4-Control (Distilled water). Each broiler was individually put in separate metabolic cage for measurement of food and water intake. The animals were exposed to continuous light and the temperature of the first week of husbandry was ranged in 31-32 ^{0}C and then the temperature were decreased 2-3 ^{0}C every week so that in the time of experiment the temperature reached to 21-24^{0}C.In this period food and water were supplied in adlibitum.

Drugs administration and feeding - drinking assessments

In this experiment Chlorpheniramine (Antagonist H1), Phamotidine (Antagonist H2) and Histamine-Dihydrochloride (Histamine inducing effects) were used. Chlorpheniramine(4 mg/kg), Phamotidine(2.5 mg/kg) and Histamine-Dihydrochloride(1 mg/kg) were administered intra-peritoneally as single dose and then the amount of food(mg) and water(ml) intake were measured in time periods as 15 min,30 min, 45 min, 60 min, 90 min ,120 min, 180 min , 240 min, 300 min, 360 min, 420 min ,480 min , 540 min, 600 min, 660 min , 720 min, 1260 min and 1380 min after the injection.

Statistical analysis

Data were analyzed using version 16 of SPSS software (SPSS Inc., Chicago, IL, USA).The results of quantitative parameters of kidney and liver were expressed as mean ± SEM. Differences between means were analyzed using one-way ANOVA, and then the means were compared with Duncan test. P values of 0.05 or less were taken as being statistically significant.

RESULTS

Our research indicates that Chlorpheniramine (Antagonist H1) and Histamine-Dihydrochloride decreased food intake in all time bouts after injection compared to control group ($p<0.0001$). Phamotidine (Antagonist H2) caused decrement in food consumption in 30 min, 45 min, 60 min, 1260 min and 1380 min after the injection($p<0.0001$).
Also the result showed that Chlorpheniramine (Antagonist H1) decreased water drink (gr) in 180 min , 240 min, 300 min, 360 min, 420 min ,480 min , 540 min, 600 min, 660 min , 720 min, after injection compared to control group ($p<0.0001$) and adversely increased water drink (gr) in 1260 min and 1380 min after the injection($p<0.0001$). Phamotidine (Antagonist H2) caused falling in water consumption in 360 min, 420 min, 480 min, 540 min, 600 min, 660 min, 720 min, 1260 min and 1380 min after the injection. ($p<0.0001$). Histamine-Dihydrochloride decreased water intake 60 min, 90 min ,120 min, 180 min , 240 min, 300 min after the injection($p<0.05$).

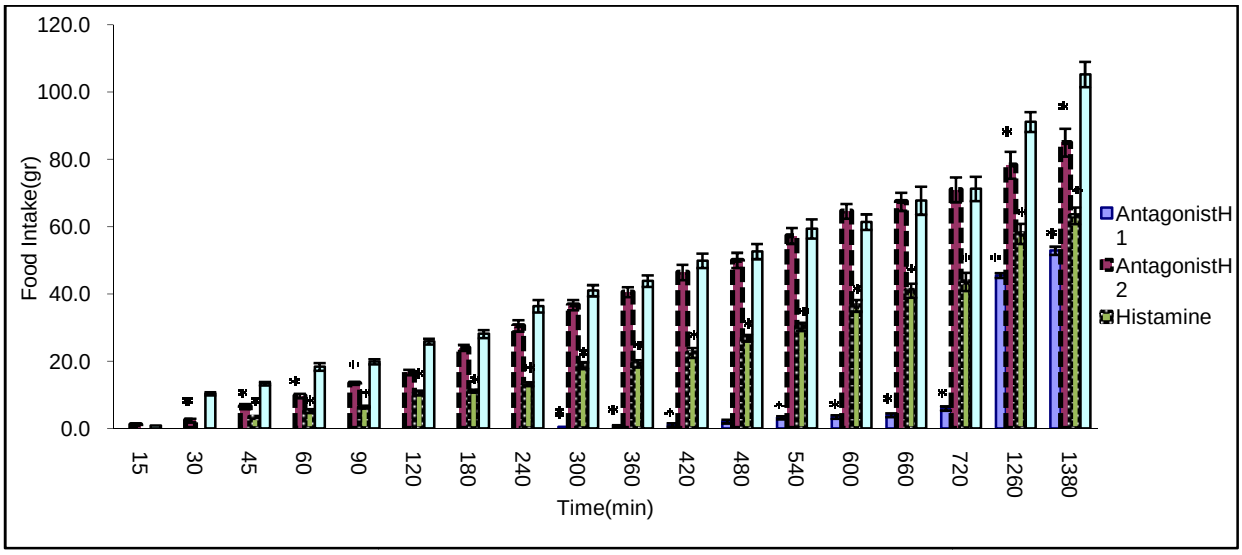

Fig. 1. Food intake of broilers after intraperitoneal injection in Chlorpheniramine (Antagonist H1), Phamotidine (Antagonist H2), Histamine-Dihydrochloride and Control

** indicating statistically difference between treatment group and control group (P<0.0001)*

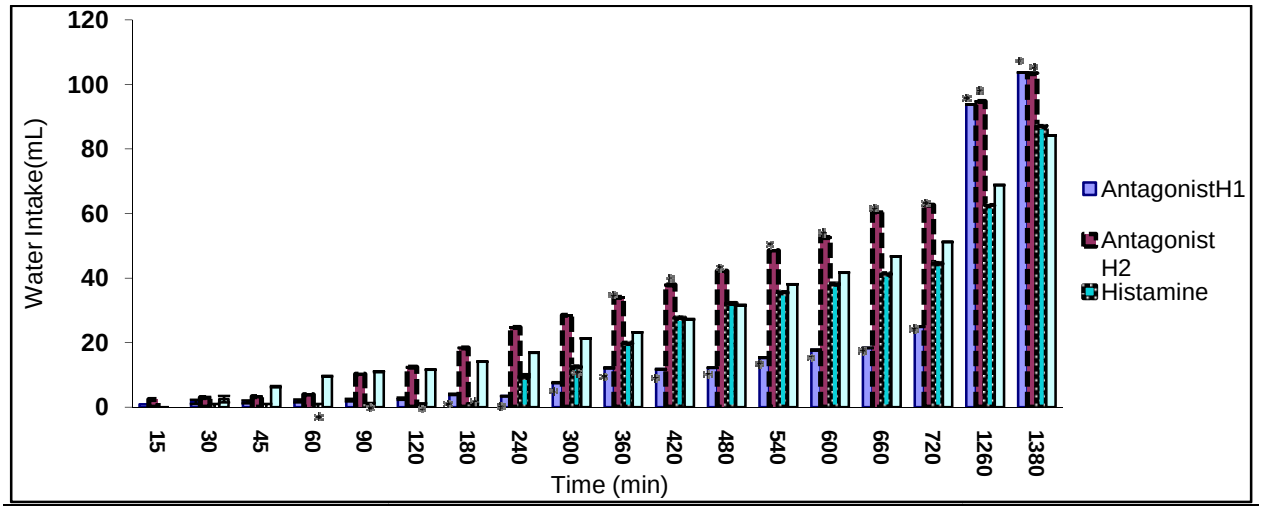

Fig. 2. Water intake of broilers after intraperitoneal injection in Chlorpheniramine (Antagonist H1), Phamotidine (Antagonist H2), Histamine and Control

**indicating statistically difference between treatment group and control group (P<0.0001)*

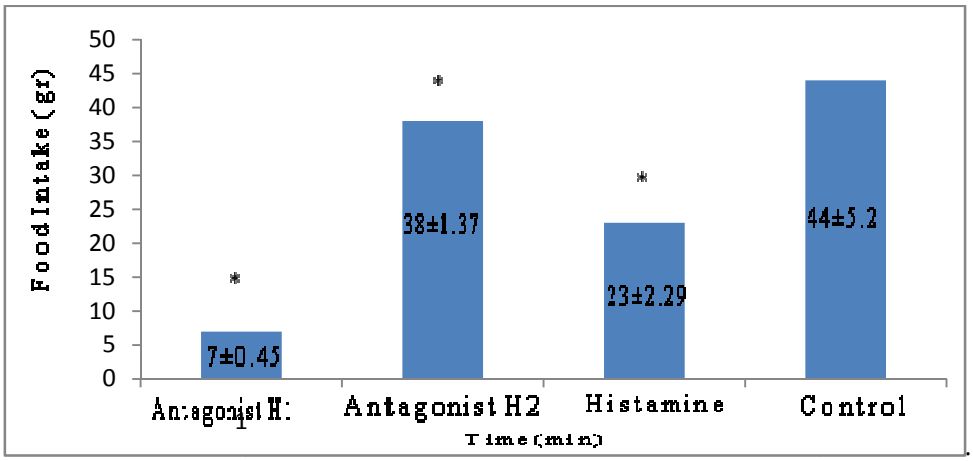

Fig. 3. Comparison of total Food intake (gr/min) among all treatment and control

** indicating statistically difference between treatment group and control group (P<0.0001)*

DISCUSSION

The appetitive phase requires a high and yet optimal arousal state and the histaminergic system is crucial for sustaining a high degree of arousal during motivated behavior. Histamine H1 receptors in the brain are crucial for the regulation of the diurnal rhythm of food intake and the regulation of obesity; however, from a therapeutic standpoint, no brain-penetrating H1 receptor agonists have been identified that would have antiobesity effects [1].In contrast we found that H1 receptor antagonist suppressed food intake. Much less is known about the mechanisms at the onset of feeding behavior or those that control meal initiation when food is freely available. It is, however, clear that decreases in either glucose or triglyceride availability are signals that converge on medial hypothalamic neurons to increase food intake. The same hypothalamic regions contain the neurons that respond to long-term signals from energy deposits, leptin, and insulin to promote food intake. Such medial hypothalamic regions then are thought to be a key site of convergence of short- and long-term signals of fuel availability and energy balance. drugs (AAPDs) stimulate appetite and induce weight gain through selective and potent stimulation of hypothalamic AMP kinase, which has been linked to the regulation of food intake [2], and reverse the actions of the anorexigenic hormone leptin. This action involves the histamine H1 receptor, because AAPD augmentation of AMP kinase is abolished in mice with deletion of histamine H1 receptors [3]. Moreover, the relative potencies of AAPDs in blocking H1 receptor have been reported to correlate with their orexigenic potencies [3, 4]. However, relatively few studies have been carried out to unequivocally establish a relationship between food consumption and H1 receptors blockade in humans [5]. Histamine neurons are crucial for sustaining a high level of arousal during motivated behavior, because histaminergic activity shows a clear circadian rhythm with high levels during the active period and low levels during

sleep [6]. Miomoto et al indicated that corticotrophin release hormone(CRH) acting on peri-ventricular nucleus regulates the appetite and CRH is affected with histaminergic system[7].

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