

CAMPYLOBACTER JEJUNI

CAMPYLOBACTER JEJUNI

Erdoğan KÜÇÜKÖNER

Yüzüncü Yıl Üniversitesi, Ziraat Fakültesi, Gıda Mühendisliği Bölümü, Van

ABSTRACT: *C. fetus* subsp. *jejuni* is one of the most common bacterial causes of acute gastroenteritis in both children and adults. The purpose of this article is to review the characteristics, growth parameters, some out breaks and fatalities related to *C. jejuni*. In addition, symptoms and source of infections (meat, poultry, raw milk and other foods) were discussed. Finally, isolation and control mechanism were given in this article.

ÖZET: *C. fetus* subsp. *jejuni* çocuklarda ve yetişkinlerde çok yaygın olarak, bakteriyel akut mide ve bağırsak iltihaplanmalarına neden olan bir etkidir. Bu makale *C. jejuni*'nin özellikleri, gelişme ve büyüme parametreleri, bazı yaptığı hastalıkları ve ölüme neden olması gibi konuları içermektedir. Bunlara ilave olarak hastalığın belirtileri, enfeksiyon kaynakları, örneğin et, tavuk, çiğ süt ve diğer gıdalar da bulunuşu tartışılmıştır. Sonunda bakterinin izolasyonu ve kontrol mekanizmaları hakkında özet bilgi verilmiştir.

INTRODUCTION

Once thought to be of importance only to veterinarians because of its early association with aborted fetuses in cattle and sheep, and with diarrhea in swine. Today *C. fetus* subsp. *jejuni* is recognized as one of the most common causes of acute bacterial gastroenteritis in humans (REYNOLDS and DRAUGHON, 1987; DOYLE, 1981; SMITH and BLASER, 1985). Evidence suggests that *Campylobacter* is responsible for at least as many cases of enteric illness as *Salmonella*. These bacteria are responsible for approximately 10% of all cases of acute human enteritis (MAFU et al., 1989). *Campylobacter* was first recognized by MCFADYEAN and STOCKMAN, who in 1913 reported that such organisms were associated with abortion in cattle and sheep. Their observation were later confirmed by SMITH, who isolated similar organisms from aborted bovine fetuses.

The first putative cases of human infection due to microaerophilic vibrio were reported by LEVYIN 1946. The infections occurred in two Illinois penal institutions where 357 of 6019 inmates were afflicted with acute gastroenteritis. The inmates suffered nausea, vomiting, abdominal pain, diarrhea, fever, chills, malaise, headache, profuse perspiration, conjunctivitis, and prostration (BRYAN, 1979; DOYLE, 1981). *C. jejuni* is an inhabitant of the gastrointestinal tract of a variety of wild and domestic animals. Foods, especially those derived from animals, are thought to be the principal vehicle for transmission of *Campylobacter enteritis* (DOYLE, 1990).

CHARACTERISTIC

Campylobacter jejuni, originally classified as *Vibrio fetus* is a member of the Spirillaceae family. All are gram negative and morphologically appear as very slender curved to spiral shaped rods that are generally from 0.2-0.4 mm wide and 1.5-3.5 mm long. The organisms are motile and move with a characteristic corkscrew-like motion that is accomplished by a single polar flagellum. Optimum growth temperature for *C. jejuni* is 42-45°C is responsible for abortion, infertility, dysentery in animals, and are agents of acute enteritis and bacteremia in humans. Although optimal growth temperature ranges between 42-45 °C, germinal inactivation occur at 48°C (DOYLE, 1990). DOYLE and ROME (1982) reported D values for the growth of organism in skim milk at 48°C ranging from 7.2-12.8 minutes. *C. jejuni* will not survive the minimum pasteurization temperature

hence a *Campylobacter* free product should be anticipated under good manufacture practices. *Campylobacter* is quite sensitive to drying and storage at room temperature. It grows well at pH 5.5-8.0 optimal growth is in the pH range of 6.5-7.5 whereas minimum pH for growth is 4.9 (BRYAN, 1979).

C. jejuni is an obligate microaerophile that requires low level of oxygen for growth and grows optimally in an atmosphere containing 5% oxygen. Carbon dioxide is also essential for growth of *C. jejuni*, with a concentration of 10% being optimal (TROLLER, 1989; BOKKENHEUSER, 1970). This organism is not able to ferment or oxidize carbohydrates. The following reactions are negative for *C. jejuni*: indol, methyl red, Voges-Proskauer, H₂S, urea, citrate, gelatin and milk. The organism fails to grow in the presence of NaCl concentration of 3.5 percent or higher (BOKKENHEUSER, 1970; TROLLER, 1986). REYNOLDS and DRAUGHON, (1987), stated that 2.0% salt level of the processed turkey roll and ham and the pH decrease during vacuum packaged of the products were the two primary factors causing inactivation of *C. jejuni*.

C. jejuni was very sensitive to drying. When contaminated spinchiller water was spread on tiles of different materials (aluminum, stainless steel, formica and ceramic), the organism survived as long as a moistened surface could be observed. They could not be isolated once surfaces could be observed. *Campylobacter* could survive on chicken carcasses and chicken livers at - 20°C for more than 64 and 84 d, respectively (OOSTERM et al., 1983).

SYMPTOMS OF THE GASTROENTERITIS CAUSED BY CAMPYLOBACTER JEJUNI

The most common symptoms of *C. jejuni* infection are fever, acute diarrhea, malaise, headache, and abdominal pain or cramps. In some people, abdominal pain may be the predominant sign of illness. Vomiting may occur but is rare. The incubation period after ingesting contaminated food is usually 48-82 hours, but can be as long as 7-10 days. The illness is usually gone within 1-4 days, and even in severe cases seldom lasts more than 10 days. About 25% of those infected have some recurrence of symptoms, which usually appear as a milder form of gastroenteritis (MARTIN, 1991; DOYLE, 1990).

Food Borne Outbreaks: FINCH and BLAKE, 1985 stated that *Campylobacter jejuni* is a major cause of diarrhea in United states: During 1980-1982, 23 food borne outbreaks of disease caused by *Campylobacter* were reported to CDC through national food borne surveillance program, which collects reports from state & territorial epidemiologist throughout USA. These outbreaks involved 748 ill persons of whom 4% were hospitalized. For outbreaks with six or more persons the median attack rate was 41%, the mean duration of symptoms ranged from 3-7 days. Raw milk was implicated or suspected in 14 outbreaks. In four of the other outbreaks, food handling errors were identified, and in 5 outbreaks, poultry, egg or beef were implicated or suspected. In three of four outbreaks in which *compylobacter* was recovered from cows at the implicated dairies, some isolates from cows were stereotypically identical to isolate from ill persons. In one egg, associated outbreak, one of the isolate of *Campylobacter* recovered from hens at the implicated egg farm was stereotypically identical to an isolate recovered from an ill person. These findings underscore the hazard of eating undercooked or raw foods of animal origin such as raw milk. Raw milk contaminated by infected cows is a major cause of foodborne Compylobacteriosis in the United States (FINCH and BLAKE, 1985).

The largest outbreak in Japan involved 2500 school children from (6-12 years) and 12-15 years old 2500 children at the two schools were supplied from the same center with a lunch of bread, pasteurized cow's milk, oranges, and vinegarred pork with vegetables. After 2 days some of them had gastrointestinal symptoms such as abdominal pain, diarrhea, nausea, vomiting and fever over 38 °C. Although the origin of food poisoning was not determine, the vinegared pork seems the most likely source. *Campylobacter* was isolated from feces obtained on the third day of the outbreak and from two stool specimens from the staff of the supply center who were symptoms free. Most patients recovered within a week but campylobacter excretion lasted over two weeks in some cases (STERN and KAZMI, 1989). An outbreak is reported in which three members of the same family became simultaneously ill with fever, severe abdominal cramps and diarrhea. *C. fetus* ss. *jejuni* was recovered from stool specimens from all three (BLASER, et al., 1979).

FATALITIES

Although *Campylobacter jejuni* is now recognized as a common cause gastroenteritis, fatalities associated with this infection in the United States have not been previously reported. Two fatalities associated with *C. jejuni* infections occurred over a two-year period in the Denver metropolitan area. The first case was in a previously healthy 26 year old woman who died following a two day diarrheal illness. The second case was in a 69 year old diabetic woman who died 19 hours after developing a gastrointestinal tract illness one day following hospital discharge for an orthopedic procedure. Both patients had taken an antimotility agent. During this same two year period there were 24 reported cases of *C. jejuni* infections per 100,000 population (SMITH and BLASER, 1985).

Campylobacter jejuni is now recognized as a common cause of gastroenteritis, with manifestations ranging from mild diarrheal illness to fulminating acute colitis. Other campylobacter species, especially *C. fetus*, have been frequently reported causing severe complications especially in debilitated hosts, but severe complications with *C. jejuni* infections appear less common. Although it has been suggested that death may occur in debilitated patients (SMITH and BLASER, 1985). The two cases described serve to demonstrate that infections with *C. jejuni* are potentially life threatening and that deaths occur even in relatively normal adult hosts. However, there have been no detailed reports of deaths associated with *C. jejuni* infections in the literature.

SOURCE OF INFECTION

Poultry and Meat:

Campylobacter is the cause of a significant percentage of bacterial food borne illness in humans and poultry maybe a vehicle responsible for a substantial portion of these illness (STERN and LINE, 1992) JUVEN and ROGOL (1986) stated that poultry have been implicated as source of *Campylobacter jejuni* infections in humans. *C. jejuni* is a natural inhabitant of chicken digestive tract and contaminates carcasses during processing (AYALA, 1992). *C. jejuni* survives rather well on refrigerated chicken, and although population are reduced upon freezing and thawing (BEUCHAT, 1986). OOSTEROM *et al* (1983) stated that *C. jejuni* contamination in chicken processing plants is almost exclusively of intestinal origin. This contamination is not sufficiently eliminated during processing (except in some cases during scalding and air-cooling) and results in contamination of poultry end-products. Both the process and end-products resulting from processing may be hazards to public health. *C. fetus* subsp. *jejuni* was present in 85% of the chicken livers and in 89% of the chicken gizzards obtained immediately after evisceration (CHRISTOPHER, *et al.*, 1982).

Poultry is frequently contaminated with *Campylobacter* forty-four to 100% of the end products at poultry processing plants are contaminated with these pathogen (AYALA, 1992). A number of studies in chickens and turkey have indicated high *C. jejuni* isolation rates both at the farm level and in the birds arriving in the slaughterhouse. The organism can survive the routine slaughtering and processing operation and has been frequently isolated from retail poultry products (KASRAZADEH and GENIGEORGIS, 1987). Chicken carcasses and water samples were tested for contamination with *C. jejuni* at water immersion stage in a kosher poultry processing factory. The results showed that there was a contamination of *C. jejuni* at water immersion stage (JUVEN and ROGOL, 1986). KASRAZADEH and GENIGERORGIS (1987) stated that the most probable source of colonization by *C. jejuni* was the *C. jejuni* carrier rats and mice found in abundance on the premises. The prevalence of *C. jejuni* in rat fecal contents 86.7%, and rat and mice droppings were found in the feeding and watering trough. In the processing plant, *C. jejuni* isolated from 96.7% of feather picker drip water samples. Isolation rates of *C. jejuni* for liver, gizzard, heart, and skin samples were 34, 20, 6, and 6.7%, respectively (KASRAZADEH and GENIGEORGIS, 1987). REYNOLDS and DRAUGHON (1987) studied *C. jejuni* in vacuum packaged processed turkey. They stated that culturable *C. jejuni* decreased significantly during vacuum packaged storage at 4°C over time. Higher levels of *C. jejuni* were detected in the turkey roll

than the turkey ham. They believe that the 2.0% salt level of the processed turkey roll and ham and the pH decrease during vacuum packaged storage of the products were the two primary factors causing inactivation of *C. jejuni* in the vacuum packaged turkey roll and ham at 4°C (REYNOLDS and DRAUGHON, 1987).

Campylobacter spp. were isolated from (Swine carcasses) 247 (61.7 %) of 400 specimens, and *C. coli*, *C. jejuni*, and *C. laridis* accounted for 97 %, 2 %, 1 % of isolates, respectively (MAFU *et al.*, 1989). BRACEWEL *et al.* (1985) stated that the contamination levels of pork carcasses by *Campylobacter* in the Northeast area of Georgia were much lower than those reported by researchers in the other locations. These differences may be attributed to differences in herd characteristic, geographic locations, as well as slaughter methods. *Campylobacter* spp. were present on 23 carcasses with 9 isolates from the shoulder area and 14 isolates from ham (EPLING *et al.*, 1993).

A few instance of *Campylobacter* infection have been linked to consumption of red meat. In one instance, an individual developed *C. fetus* subsp. *fetus* septicemia eating raw beef liver (STERN and KAZMI, 1989).

Milk

The first reported instance of human *Campylobacter enteritis* implicated raw milk as the vehicle for the ineffective agent. Recently, raw milk has been frequently described as the vehicle for foodborne enteritis caused by *Campylobacter jejuni* (LOVETT *et al.*, 1983; McMANUS and LANIER, 1987). Survival of *Campylobacter* in milk varies depending on the strain of *C. jejuni*, the composition and microbial population of milk, the composition of the atmosphere, and probably other unidentified factors (KOIDIS and DOYLE, 1984). LOVETT *et al.* (1983), reported that 195 farms yielded a farm incidence rate of 1.5 %. These studies, using two separate but sensitive methods, indicate that the incidence of *C. jejuni* in farm bulk milk is at the level of 1 to 2 %. *C. jejuni* was isolated from 1 to 108 milk samples obtained from bulk tanks of nine grade A dairy farms. Survival of eight *Campylobacter* strains in unpasteurized milk (4°C) varied greatly. One strain was still recoverable 21 days after inoculation of milk (DOYLE and ROMAN, 1982).

ISOLATION

Agar media for isolating *C. jejuni* from foods evolved from the needs of clinical microbiologists. These selective media were developed to recover the organism from stools of patients with gastroenteritis and were subsequently used for isolating *C. jejuni* from foods. Most prominent among these selective media are the Butzler formulation, the Skirrow formulation, the Campy-BAP formulation and the most recently, the Presron blood-free medium (DOYLE, 1989; BEUCHAT, 1986).

Selective agar plates should be examined for typical colonies of *C. jejuni* at 24, 48, and 72 h of incubation at 42 °C. Typical colonies of *C. jejuni* on blood-supplemented selective agar are translucent, nonhemolytic, flat or slightly raised, round or with an irregular edge, and appear gray pink (STERN and KAZMI, 1989). *C. jejuni* is identified by its characteristic darting corkscrew like motility with a phase-contrast microscope, by its common S, gull, and spiral shaped cellular morphology. Biochemical tests, include in ability to ferment or oxidize glucose, ability to grow at 37 or 42°C but not at 25 °C, ability to hydrolyze hippurate, inability to grow in 3.5% NaCl, ability reduce nitrate, production of H₂S in cysteine medium as detected by a lead acetate paper strip, and possession of catalase and oxidase activity (DOYLE, 1990; DOYLE, 1984)

CONTROL MECHANISM

Campylobacter jejuni is usually present in the feces of warm blooded animals, so to keep them out of animal foods entirely is perhaps impossible. However, extreme cleanliness and sanitation in slaughtering and processing operations, coupled with good personal hygiene of slaughter house workers, is probably the single most important step in preventing spread of the organism to humans. Careful control of refrigeration temperatures during handling and storage of processed carcasses is extremely important. *C. jejuni* infections

can be prevented by properly pasteurizing or cooking foods (especially foods of animal origin) and avoiding cross contamination of cooked or ready to eat foods by utensils, equipment or cutting surfaces that are properly cleaned and disinfected after contact with fresh, uncooked meats and foods. Good food handling practices in homes, restaurants, and institutions will go along way toward preventing *Campylobacter jejuni* foodborne infections (MARTIN, 1991).

C. jejuni is a fragile organism that is inactivated by most methods commonly used to eliminate enteropathogens from foods. The only means available for protecting health with current processing and food preparation procedures is through consumer education and reinforcement of hygienic practices. Care is required to segregate raw products and processing utensils from any food or material that will directly, or indirectly, come in contact with the consumer. An alternative approach is intervention in the commensal relationship between *C. jejuni* and the intestinal niche occupied in the livestock animal. By preventing the organism from colonizing the food animal, contamination of meat products is reduced greatly and the potential for foodborne transmission is diminished (STERN and KAZMI, 1989).

CHRISTOPER et al., (1982), described prevention as follow; (a) avoiding cross contamination of this organism to other foods (which may not receive further heating) by contact with contaminated utensils such as cutting boards and knives, and (b) proper heat treatment of the food.

REFERENCES

- AYALA, A.C. 1992. Comparison of Selective Enrichment Broths for Isolation of *Campylobacter jejuni/ coli* from Freshly Deboned Market Chicken. J. Food.Prot. 55: 333-336.
- BEUCHAT, L.R. 1986. Methods for Detecting and Enumerating *Campylobacter jejuni* and *Campylobacter* in Poultry. Poultry Sci. 65: 2192-2198.
- BLASER,M.J., J.CRAVENS., B.W. POWERS., F.M. LAFORCE., and W.L.L. WANG. 1979. *Campylobacter enteritis* Associated With Unpasteurized Milk. Am. J. Med. 67: 715-718.
- BOKKENHEUSER,V. 1970. Vibrio Fetus Infection in Man. Am. J. Epi. 91: 400-409.
- BRACEWEL, A.J. , J.O. REAGAN, J.A. CARPENTER and L.C. BLANKENSHIP. 1985. Incidence of *Campylobacter jejuni/coli* on Pork Carcasses in the Northeast Georgia Area. J. Food. Prot. 48: 808-810.
- BRYAN,F.L. 1979. Food Borne Infections and Intoxcations. Second Ed. Academic Press. Inc.New York.
- CHRISTOPHER, F.M., G.C.SMITH and C.VANDERZANI. 1982. Examination of Poultry Giblets, Raw Milk and Meat for *Capylobacter fetus* subsp. *jejuni*. J. Food. Prot. 45: 260-262.
- DOYLE,M.P. 1981. *Campylobacter fetus* subsp. *jejuni*: An Old Pathogen of New Concern. J. Food. Prot. 44: 480-488.
- DOYLE, M.P. and D.J.ROMAN. 1982. Prevalence and Survival of *Campylobacter jejuni* in Unpasteurized Milk. Appl. Envir. Mic. 44: 1154-1158.
- DOYLE, M.P. 1984. *Campylobacter* in foods. "in *Campylobacter* Infections in Man and Animals, Ed. J.P, Butzler, pp. 163-180," CRC Press Boca Raton, Florida.
- DOYLE, M. P 1990. Foodborne Diseases, Ed. D.O. Cliver, pp. 217-222. Acedemic Press Inc. Harcourt Brace Javonovich, Publishers. New York.
- EPLING, L.K., J. A. CARPENTER and L .C. BLANKENSHIP. 1993. Prevalence of *Campylobacter* spp. and *Salmonella* spp. on Pork Carcasses and the Reduction Effected by Spraying With Lactic Acid. J. Food.Prot. 56: 536-537.
- FINCH, M.J. and P.A. BLAKE. 1985. Foodborne Outbreaks of *Campylobacteriosis*: The United States Experience 1980-1982. Am. J. Epidemiology. 122: 262-267.
- JUVEN, B.J. and M. ROGOL. 1986. Incidence of *Campylobacter jejuni* and *Campylobacter coli* Serogroups in a Chicken Processing Factory. J. Food. Prot. 49:290-292.
- KASRAZADEH, M., and C. GENIGEORGIS. 1987. Origin and Prevalence of *Campylobacter jejuni* in Ducks and Duck Meat at the Farm and Processing Plant Level. J. Food. Prot. 50: 321-326.
- KOIDIS,P. and M.P. DOYLE. 1984. Procedure for Increaaed Recovery of *Campylobacter jejuni* from Inoculated Unpasteurized Milk. Appl. Envir. Mic. 47: 455-460.
- LOVETT.J. ,D.W. Francis and J. M. HUNT. 1983. Isolation of *Campylobacter jejuni* from Raw Milk. Appl. Envir. Mic. 46: 459-462.

- MAFU, A A., R .HIGGINS., M .NADEAV and G. COUSINEAU. 1989. The Incidence of *Salmonella*, *Campylobacter*, and *Yersinia enterocolitica* in Swine Carcasses and the Slaughterhouse Environment. J. Food. Prot. 52: 642-645.
- McMANUS, C., and J.M. LANIER. 1987. *Salmonella*, *Campylobacter jejuni*, and *Yersinia enterocolitica* in Raw Milk. J. Food. Prot. 50: 51-55.
- MARTIN, J.H. 1991. Emerging Foodborne Pathogens: *Campylobacter jejuni*. Ohio Cooperative Extension Service The Ohio State University.
- PRESSCOTT, J.F., and D.L MUNROE. 1982. *Campylobacter jejuni* enteritis in man and domestic animals. JAVMA, 181:1524-1529.
- OOSTEROM, J., De WILDE, G.J.A., De BOER, E., De BLAAUW, L.H., and H. KARMAN. 1983. Survival of *Campylobacter jejuni* during Poultry Processing and Pig Slaughtering. J. Food Prot. 46:702-706.
- OOSTEROM, J., S. NOTERMANS., H. KARMAN and G. B. ENGELS. 1983. Origin and Prevalence of *Campylobacter jejuni* in Poultry Processing. J. Food. Prot. 46: 339-344.
- REYNOLDS, G.N., and F. A. DRAUGHON. 1987. *Campylobacter jejuni* in Vacuum Packaged Processed Turkey. J. Food. Prot. 50: 300-304.
- SMITH, G. S., and M.J. BLASTER, 1985, *Campylobacter*. Fatalities Associated with *Campylobacter* Infections. J.A.M.A. 253:2873-2875.
- STERN, N. J. and S. U. KAZMI. 1989. *Campylobacter jejuni* In Foodborne Bacterial Pathogens (M. P DOYLE, ed.), pp. 71-110. Dekker, New York.
- STERN, N.J. and J.E. LINE. 1992. Comparison of Three Methods for Recovery of *Campylobacter* spp. from Broiler - Carcasses. J. Food. Prot. 55: 663-666.
- TROLLER, J.A. 1986. Water Relations of Foodborne Bacterial Pathogens- An Updated Review. J. Food. Prot. 49: 656-670.

TÜREKS

MÜHENDİSLİK VE DANIŞMANLIK

Kurumumuz 25 Yıllık Tecrübesi ile aşağıdaki konularda hizmet vermektedir. Firmamız, Ankara Üniversitesi Ziraat Fakültesi Gıda, Makine, Ekonomi ve Süt Teknolojisi Bölümünden Mezun Yönetim Kadrosundan ve tüm mühendislik dalında hizmet verebilecek teknik kadrodan oluşmaktadır.

Müşteri istekleri ya da etkili bir yönetim için uygulayabileceğiniz sistemler için, EĞİTİM, DANIŞMANLIK ve BELGELENDİRME hizmeti vermekteyiz.

- ▼ ISO-9000 Kalite Yönetim Sistemi
- ▼ HACCP (Kritik Kontrol Noktalarında Tehlike Analizi) Gıda Emniyeti Sistemi
- ▼ ISO-14000 Çevre Yönetim Sistemi
- ▼ AQAP 110-120 Nato Kalite Güvence Sistemi (Milli Savunma Bakanlığından)
- ▼ CE Markası Avrupa Normlarına Uygunluk Belgesi
- ▼ TSE Belgesi, İş Yeri Yeterlilik Ya da Ürün Yeterlilik Belgesi, (Türk Standartları Enstitüsü)
- ▼ Yatırım Teşvik Belgesi Alınması
- ▼ Fizibilite Hazırlama ve Teknoloji Seçimi

İşletmelerin yaşamları için zorunlu hale getirilen resmi belgeler ve izinlerin dosyalarının hazırlanması ve takibinin yapılması hizmeti vermekteyiz.

- ▼ Gıda Üretim İzni ve Gıda Sicili Hizmetleri (Tarım Bakanlığından Gıda, Ambalaj İşletmeleri İçin Zorunlu İzinlerdir.)
- ▼ Gayri Sıhhi Müesseseler İçin Çalışma İzni (Sağlık Bakanlığından Gıda, Ambalaj İşletmeleri İçin Zorunlu İzinlerdir.)
- ▼ ÇED (Çevresel Etki Değerlendirmesi) Raporu (Çevre Bakanlığına Haziran 1997'den sonra Kurulan Gıda İşletmeleri İçin Zorunlu İzinlerdir)
- ▼ Marka Tescili ve Patent (Türk Patent Enstitüsünün Tüm Firmalar İçin Oluşturduğu Belge)
- ▼ Kapasite Raporu (Ticaret ve Sanayi odasının Üretici Firmalar İçin Oluşturduğu Belge)

ADRES: Gimat 3. Blok No: 29 Macunköy / ANKARA

Tel: (0312) 397 07 87 - (0312) 397 60 09 Fax: (0312) 397 00 58 E-mail: tureks@tr.net